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A Treatise on Fractures.

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By Prof. Armand Després.

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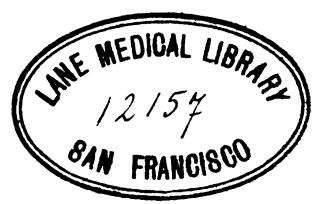
BY

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PREFACE.

This little volume is taken from the third edition of the *Chirurgie Journalière* of Professor Armand Després.

It was not designed to be a complete treatise on Fractures, but to embody the author's ripe experience in the treatment of the more common fractures, and to be a guide to the ordinary practitioner. Professor Després does not give many methods—he presents only those which have given him the best results.

The book may possibly be open to the criticism that some chapters are treated with too much fulness of detail. while much is omitted that should have been given. It would, however, be a difficult matter, in a volume of this size, on so vast a subject, to meet all the requirements of the most exacting criticism. Special treatises on fractures are not lacking, and the American practitioner who wants a full presentation of the subject will find this in the work of Hamilton. It will be recognized, nevertheless, that the author of this book treats his topics with much independence and originality, that his methods are characterized by sound judgment and practical common sense, and that a treatise of this size will have a certain utility.

It would have been easy for the translator to have greatly increased the proportions of this volume by additions of his own, embodying the most approved English and American methods. This, except in a few instances, he has refrained from doing. The additions which he has made are enclosed in brackets.

TABLE OF CONTENTS.

CHAPTER I.

PAGE.

General Principles of the Treatment of Fractures—Fractures of the Lower Extremity of the Radius—Opportune Moment for the Application of the First Apparatus—Duration of the Treatment—Fractures of the Body of the Clavicle—Criticism of Apparatus—Boyer's Apparatus—Treatment of Fractures of the Clavicle in Children..... 1

CHAPTER II.

Fractures of the Humerus..... 19

CHAPTER III.

Fractures of the Ribs—Fractures of the Phalanges of the Fingers and Metacarpal Bones—Fracture of the Olecranon..... 34

CHAPTER IV.

Treatment of Fractures of the Thigh—Choice of Apparatus—Apparatus of Hennequin—The American Method, etc..... 54

CHAPTER V.

Treatment of Fractures of the Leg..... 79

CHAPTER VI.

Fractures of the Patella..... 103

CHAPTER I.

TREATMENT OF COMMON FRACTURES.

SUMMARY.—General Principles of the Treatment of Fractures —Fractures of the Lower Extremity of the Radius—Opportune Moment for the Application of the First Apparatus—Duration of the Treatment—Fractures of the Body of the Clavicle—Criticism of Apparatus—Boyer's Apparatus—Treatment of Fractures of the Clavicle in Children.

The treatment of fractures is very simple, and in carrying out this treatment, we start from the principle that the displacement in fractures is exclusively due:

1. *To the contractions of the muscles.*

2. *To the pain which exaggerates the contractions of the muscles.*

All that is necessary to be done in order to obtain the reduction of a fracture during the time necessary for the first agglutination of the fractured surfaces, *i.e.*, twelve days, in ordinary conditions, is then to place the limb in a position which prevents all movement, the cause of pain, and as far as possible to keep the muscles at rest. To attain this object, certain immovable apparatuses, as splints, whenever they can be applied properly, are the best means. In all parts where the splints are not applicable, we are obliiged to have recourse to position.

Two special fractures demand a different man-

agement: fracture of the femur requires continuous extension; fracture of the neck of the femur, recumbency in Bonnet's trough. Fractures of the ribs, however complicated, are best treated by large strips of sticking plaster passed twice around the thorax. Fractures of the joints require: at the knee, the trough-shaped splint; at the elbow, the gutta percha mould, for fracture of the olecranon especially, and early mobilization—from the twentieth day.

But for most of the fractures, it is sufficient to place the parts in a good position, and to prevent movements.* As soon as the preliminary process of the formation of a callus is accomplished, when the organization of the elements of reparation has formed a sort of glue which binds end to end the broken bones, the retention may be less rigorous, for at this moment the muscles have lost much of their power by reason of the prolonged rest; consecutive displacements are not to be feared from the muscular movements alone, and with the exception of a slight incurvation of the bone at the seat of the fracture, there is nothing to dread, and for the remainder of the time, some light apparatus and a good position of the member are sufficient during the final consoli-

* Gerdy and Alph. Robert formerly proposed to treat fractures by simple position, fractures of the fibula and clavicle for instance; but this mode of treatment has been abandoned, as it requires that the patient shall remain in bed and keep in a painful position.

dation of the callus. The main thing is not too soon to permit movements which may bring into exercise the injured member.

You will presently see the application of these principles to the common fractures which you will continually be called upon to treat.

FRACTURES OF THE INFERIOR EXTREMITY OF THE RADIUS.

There is a very common fracture to which I shall briefly call your attention: I refer to fracture of the lower extremity of the radius.

The causes, the mechanism, the displacement, and the subsequent untoward sequelæ of this fracture we need not here discuss; all surgeons are now pretty well agreed on this subject.

As for the treatment, it is that of Nelaton which is generally adopted. I shall particularize two points only:

Is it the better way to reduce the fracture, and to apply the Nelaton apparatus from the very first day? How long should the splints be left on?

With reference to the first point, I am of Nelaton's opinion that the reduction is not necessary; the apparatus when well applied reduces the fracture by degrees and without pain. But experience proves that we ought not put up the member in splints till 24 or 36 hours have elapsed. Splints are worse than useless if tightly placed before the swelling comes on, for when the fore-arm is bandaged even with moderate tightness at the time of the fracture, the retentive apparatus produces an uncomfortable and even excessive compression of the member as soon as the swelling appears, and may even interrupt the circulation. Then one of two

things must take place; either the splint must be removed, to be afterwards reapplied more loosely, or the patient will experience atrocious pains, and eschars will be produced at the points where the splints press. When, on the contrary, the member is placed on a cushion, and warm fomentations or cataplasms are applied over the seat of the fracture for twenty-four hours, the patient remaining in bed, the pain is kept in abeyance, and when you finally put on the splints, the swelling has already begun to subside, and the patient will be able well to endure a considerable degree of constriction. As you see, nothing is lost as far as the good results of the treatment are concerned, and the patient is the better for the delay.

The first dressing is generally left on too long. On this second point I must say a word: You should continue the Nelaton apparatus ten days only, and once, at least, during this time—say the fifth day—you should remove the splints and uncover the fore-arm, to see whether the skin is excoriated in places where the splints make the most pressure. The tenth day you put on the starch or silicated bandage well padded. I shall presently indicate to you the manner.

This is the way to apply the first dressing:

The fore-arm, bent at a right angle, is placed in semi-supination. A dorsal splint, extending from the upper part of the radius to the middle of the

metacarpals of the hand is applied over a graduated compress on the dorsal aspect of the fore-arm. A linen pad is interposed between the inferior extremity of the splint and the metacarpus. A palmar splint extending from the bend of the elbow (so as not to hinder the flexion of the fore-arm) to the median fold or lower transverse crease of the carpus

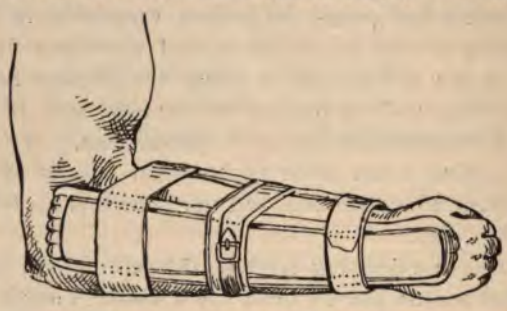


FIG. 1. Splint for fracture of the inferior extremity of the radius. One elastic strap over the middle adhesive band.

is applied over the graduated compress. The two splints are confined by three strips of sticking-plaster two fingers' breadth in width, or, better still, by three elastic straps of the same width, which are fastened with buckles.

I much prefer the elastic straps with buckles, which may be tightened or loosened at will without deranging the apparatus. One may, however, obtain an equally good result by applying only one elastic strap over the middle strip of diachylon. A spica

bandage from the wrist confines and restrains the movements of the fingers.

The immovable dressing ought to be placed on the tenth day. The wrist and fore-arm are enveloped with a thick layer of wadding, and this is covered with a tight silicate, plaster, or starch, bandage. The hand is left out. [If the silicated dressing is preferred, the liquid glass of the pharmacist is painted over a muslin bandage with a large brush. In many cases, especially adult subjects, plaster of Paris is to be preferred, (the starch bandage is hardly stiff enough). Over the wadding with which the fore-arm is enveloped, a few turns of linen bandage are rolled, and over this, plaster of Paris paste is rubbed; or the bandage may be put on after having been soaked in the plaster of Paris paste, which should be of about the consistence of cream. This makes a good stiff dressing.] It is well to leave the hand as free as possible, for what protracts convalescence in fractures of the lower extremity of the radius is the stiffness of the wrist, and especially the difficulty of movement of thumb, whose flexors and extensors are contused in Colles' fracture. Any bandage that imprisons the thumb is likely to be painful.

You have often seen me apply this immovable apparatus, which, when well hardened, constitutes a sort of pipe tapering toward the wrist where it is a little tighter than at any other part. We leave the arm free with this dressing and allow the patient all the

movements of the hand possible to make without pain.

In young subjects, this dressing is removed at the end of a month. During the month which follows, there is more or less of swelling, and the third month the hand regains its power.

In aged subjects, where there is always some degree of crushing of the inferior fragment, the



FIG. 2. Silicate or starched bandage for fracture of the inferior extremity of the radius.

apparatus ought to remain in place six weeks, and during the month which follows, it is well to make a slight compression on the carpus and inferior extremity of the forearm with a woolen bandage; this precaution is especially useful when you have to do with rheumatic patients, in whom this fracture is generally attended with an invasion of rheumatism in the wrist joint.

You will certainly have to treat fractures from which the convalescence will be very much longer, and you ought well to understand the nature of the complications which you will have to meet; the stiffness of the joints, the imperfect movements, and the pains are not due altogether to the fracture of the radius, but chiefly to sprain of the inferior radio-ulnar articulation, or to the forcible tearing away of the styloid process of the ulna; accidents produced at the time of the fracture of the radius. Only those patients who have been treated by the palmar plaster splint have a stiffness of the wrist imputable to the treatment alone.

You should also bear in mind that fractures of the radius with crushing of the lower fragment, a fracture common in old subjects from falls on the palm of the hand, are longer in getting well than simple fractures, and that the consecutive deformity is relatively considerable; the patients sometimes find it a real inconvenience and impediment, but every thing rights itself with time.

At the same time, take care not too long to confine the wrist, or it may require almost a year of massage and of local baths to restore to the hand the necessary movements of which the prolonged immobilization has deprived it.

FRACTURES OF THE BODY OF THE CLAVICLE.

Fractures of the extremities of the clavicle are always sufficiently treated by immobilization of the arm of the affected side in a simple sling kept on for thirty days.

Whatever may be the seat of the fracture which occupies the body of the clavicle, and whatever may be the cause, fractures of this bone never get well without a callus which is apparent, and sometimes unsightly.

The prize founded by Boyer, and offered for the discovery of an apparatus capable of preventing the deformity consecutive to fractures of the clavicle, has not yet been won, and I do not think it ever will be.

There is no fracture for which so many different modes of treatment have been devised. These may be reduced to four types:

1. Those that fix the arm in a position which produces the utmost possible separation of the fragments of the clavicle; such is the apparatus of Desault with the axillary pad, and those which pattern after it, and the two elastic straps with buckles of Malgaigne and Morel-Lavallée.

2. Those which draw the shoulder back so as to produce an elongation of the clavicle and separate the fragments which are inclined to dove-tail upon each other; such as the old iron figure T apparatus applied to the back.

3. The splints moulded to the neck and shoulders, popularized by Demarquay, but which failed so completely in the case of a princess of the last court.

4. Lastly Boyer's buckled bandage.

None of these apparatuses have given the results which were expected.

If no retentive appliances can completely reduce a fracture of the clavicle, and if it be possible to obtain a minimum of deformity with a mere sling or body bandage, it is certainly some gain, by these simple means, to save patients from the severe sufferings which Desault's bandage and the moulded apparatuses cause. The position of the arm on the trunk, the hand resting on the sound shoulder, as with Desault's bandage, is very painful. The pressure of an apparatus moulded to the neck and pressing on the clavicles is no less so. A corset adjusted and laced behind, forming a sort of mould to the shoulders, does not prevent shortening, and causes suffering.

Boyer, with his great good sense, saw that the position of the arm fixed to the trunk and maintained by a leather belt with buckles which kept the elbow near the body, reduced the fracture of the clavicle as well as the Desault bandage. He had remarked that this bandage was well supported by patients. To prevent this belt from falling on the hips during the upright posture, two suspenders were

attached to it which kept up the belt; one of these suspenders pressed upon the fragment of the clavicle which was uppermost and helped keep it in place.

Boyer's apparatus is a good one, but there are several disadvantages; it is heavy, does not fit every body being either too large or too small, and hence it is necessary to have a good many of them on hand.

You see daily employed in our hospital service a simple apparatus, very easy to make, which is in reality Boyer's bandage modified somewhat; only it has the immense advantage that it can be made anywhere, with what is always at hand, cotton cloth and pins.



FIG. 3.—Apparatus for fracture of the clavicle.

A body bandage or wide towel folded double is first fitted to the body; two suspender straps are sewed to it posteriorly by which the bandage is divided into a longer and a shorter segment. On the shorter segment an elbow guard is made by forming a triangular fold or plait and stitching it to the bandage; this fold is carried along to the free extremity and so sewed to the bandage as to include the forearm and hand, which now, with the elbow are enclosed as in a pocket. The bandage is now adjusted by placing these parts in their proper position, bringing the long segment around from the back to the front and pinning it firmly to the shorter segment containing the forearm and elbow; the suspenders are firmly attached by safety pins above and below to the shorter segment. Enough safety pins are inserted to make the bandage perfectly tight. One of the suspender straps passes over the clavicle and makes pressure, as much as is deemed necessary, over the internal fragment.

There are certain rules to follow in order that this apparatus may remain well in place, and not hurt the patient.

The hand of the affected side should be left free and hanging, and the wrist should be just in front of the median line. It is a great relief to the patient to have the hand free, and to be able to move the fingers at will. A little wadding should be placed between the elbow and the sling

which supports it, for the pressure on the outer part of that joint is likely to cause excoriation, even though the bandage should not be very tight.

One of the two suspenders passes over the internal fragment of the clavicle and keeps it in place, but if it is the external fragment which tends to ride over the other, it is over this that the strap should be placed. When the patient is in bed, the bandage tends to shift upwards, and the suspenders are of no use; it is, however, better for the fracture that the patient should be up and stirring about, for during the standing position, the weight of the fore-arm pulls on the clavicle by means of the suspenders, and keeps the fracture reduced as much as is possible. In cases where the patients are kept in bed for any cause, as a wound, and where it is desirable to exercise a constant compression on the clavicle, two perineal straps are attached to the body bandage to prevent the latter from slipping up, and then the suspenders, always on the stretch, exert on the fracture the desired compression.

The apparatus should be removed on the twentieth day with adults, on the fifteenth with children, and for the following twenty days the patient keeps the hand and fore-arm in a simple sling. For all fractures of the clavicle with or without wound, this treatment will never disappoint.

If there is a wound without comminuted fracture, you will confine the occluding dressing with sticking

plaster, and over this put a compress which is itself kept in place by the suspenders of the body bandage. If there are loose splinters of bone, they are to be removed, and strips of diachylon are to be applied, which must be often renewed if there is abundant suppuration at the seat of the fracture.

In both cases, the body bandage ought to be kept on longer than in uncomplicated cases, and to prevent stiffness of the joints, you will commence passive motion at the shoulder and elbow at the end of the first month; this must be practised daily.

I cannot finish this lecture without reminding you that you have seen at the clinic a number of cases of fracture of the clavicle in children. In all the cases where the fracture came on after a fall on the shoulder or elbow, there was not a great amount of displacement, and this is why the children got well without any very apparent callus. Fractures of the clavicle in children are generally very oblique and incomplete; hence there is little deformity, and this gradually disappears almost completely with the development of the bone.

The same bandage is applied as in the case of adults. The little patients are allowed to go about and play with the dressing, which hardly needs to be tightened three times during the fifteen days; at the end of this time, they may carry the arm in a sling and begin to use the hand. At the end of another fortnight they are well; it needs, in fact, but a

month for a fractured clavicle to be consolidated in children and youth.

Some surgeons treat fracture of the clavicle in children by keeping the arm in a sling; this is good treatment only on condition that the arm be kept fixed, and there is no better way to immobilize this member than to put on the child's clothes over the arm in a sling. The arm thus treated becomes almost as well confined as in the modified Boyer apparatus which I have shown you. At the end of a fortnight, the child may carry the arm in a sling over its clothes.

APPENDIX.

[MILLER'S SURGERY, VOL. II. (AM ED.), P. 320.]

Two fractures of the lower part of the radius have been described: Colles's fracture, described by Colles in the Edin. Med. and Surg. Journal, 1814, and Barton's fracture, described by Barton, of Philadelphia, in 1838. In the former, the fracture is usually transverse, and its most common seat is from three-fourths of an inch to an inch above the radio-carpal articulation. In Barton's fracture, the fragment is broken off from the margin of the articular surface of the radius, the fracture extending through the cartilaginous face of the bone and into the joint.

The character of the deformity in both cases is the same, and the treatment is identical, but the prognosis as to complete restoration of the motions of the radio-carpal articulation is probably less favorable in Barton's than in Colles's fracture, because inflammation of the joint is likely to be more severe in the former than in the latter.

This incomplete recovery is an important matter for consideration in the history of this fracture. It is not commonly observed in young, or even middle aged persons, if due attention is paid to the timely and faithful performance of passive motion during the whole period of the treatment. But in elderly persons, and especially in such as suffer from chronic or subacute rheumatism, it is not at all unusual to find at the end of the treatment, that the patient has little or no control over the wrists and finger joints, and that this condition is permanent, with but comparatively slight improvement; and this, notwithstanding the utmost care on the part of the surgeon in preventing inflammation, making passive motion from an early period, etc. In order to counteract this difficulty, Dr. Bond, of Philadelphia, has contrived a splint which allows

lows the patient to bend the fingers and wrist pretty freely, while at the same time the fragments are kept securely in apposition and at rest, and the whole arm in a comfortable position. The splint is made of light wood, cut to the shape of the forearm, and extends from the elbow to the second joint of the fingers. To its palmar extremity is to be firmly attached, by screws or nails, a carved and rounded block of wood of the size of the patient's hand, which the latter will grasp when the arm is extended on the splint. The splint may, or may not be, according to fancy or convenience, covered with binder's board, the edges of which shall project beyond the sides of the splint, and be turned up, so as to form a kind of box for the arm. If the binder's board be not used, the splint is wrapped, as usual, in a roller or in muslin, the arm is placed upon it, the fingers are allowed to rest comfortably, or to be moved at pleasure upon the carved block; a compress is to be placed under the arm at the point of fracture, just large enough to fill up any vacuity which the shape of the part may occasion after the fracture is reduced; another compress is to be laid on the dorsal face of the limb, opposite the first, and the arm is lightly secured to the splint by a roller. This splint is now constantly employed at the Pennsylvania Hospital, and by surgeons in practice in that city, and meets with uniform approval. Levis' copper splint manufactured by Snowden, of Philadelphia, is in the judgment of the translator, an equally good splint.]

CHAPTER II.

FRACTURES OF THE HUMERUS.

For fracture of the arm from the head of the humerus to the inferior third, or the neighborhood of the elbow joint, the apparatuses hitherto devised and still in common use seem to me imperfectly to meet the requirements, and I believe them to be attended with serious disadvantages.

Boyer's four splints applied over a roller enveloping the member from the hand to the shoulder, constitutes a bad dressing. The callus which is obtained is never regular, and there is always a more or less marked overlapping of one of the fragments.

The simple trough-shaped splints, or the metallic hollow splints moulded to the arm, are the best, but they are not suitable for every-day practice, because the splint must necessarily vary in length aud breadth for each subject, and one would need almost as many splints as he had patients. On the other hand, the hollow splint is always easily disarranged and got out of place; it must be kept applied close to the thorax, and this tin apparatus cannot be tolerated by the patient unless the chest be protected. These are complications which render difficult the efficacious usage of this appliance.

The double, padded, hollow splint of Bonnet, a large trough destined to surround the thorax, to

which is attached a smaller trough for the arm, is a good apparatus, but there is always a difficulty in keeping it in place; it ought not to slip up or down, and no appliance which requires constant watching is to be commended. Bonnet tried to remedy this inconvenience of his splint by continuous extension of the arm by means of a weight. Such extension is extremely painful, and can only be applied while the patient is standing.



Fig. 4.—Bonnet's thoracic trough for fracture of the upper extremity of the humerus.

The immovable apparatuses with plaster or dextrine are insufficient or dangerous; it is necessary to include the entire superior member from the wrist to the shoulder, and keep the arm in a sling. The displacements of the fracture the most to be feared

are the displacements by rotation. The apparatus of Flüher—a flannel bandage surrounding the limb, four wrought-iron linear splints, and a roller over the whole—constitutes an excellent dressing which, however, requires watching, and in order that it may remain in place, the entire member must be immobilized. At the same time, I do not regard this apparatus as superior to the others.

You have seen a patient who had been treated for fracture of the humerus out of the hospital by the immovable apparatus which was put on the very first day. When he came into the hospital, there was rigidity of the shoulder joint, elbow and wrist, as the result of six weeks wearing of the apparatus. It took a month to overcome the stiffness of the joints. You saw, nevertheless, that there was an incurvation of the humerus and a very prominent callus, despite the employ of this apparatus.

In general, every kind of retentive apparatus sufficient to keep the fracture in place must be very tight, and however tight it may be, the broken fragments will never be sufficiently confined in their place to unite without apparent callus, and slight incurvation of the bone. It was only after having seen the results of treatment by all or almost all these appliances, that I abandoned the four splints, the trough, and the immovable apparatuses. The latter especially seem to me to possess one great disadvantage; when made to extend from the tip of the shoulder which is

confined with the arm to ensure the solidity of the bandage, the joint is completely immobilized. Are we certain when we employ any of these fixed dressings, no matter with how much care they may be applied, that we shall obtain a perfectly regular callus, that is to say, a soldering of the fragments end to end? I do not hesitate to say no; all the fractures of the arm that I have seen, present after recovery a prominent callus and a perceptible curvature of the humerus, and all the different apparatuses which I have mentioned above had been employed. Nevertheless the patients had good use of their limb, and experienced no inconvenience from the fracture.

This proves that we may look in vain for an apparatus capable of preventing all deformity, and this is easy to understand, for no splint can press directly on the bone; the biceps, triceps and brachialis anticus are interposed between the splint and the bone, and the displacement can only be avoided by absolute rest of the muscles, which in the present case is very difficult to obtain. Consequently, if the deformity is inevitable, the simplest apparatus, and that which is the least annoying to the patient, provided that it sufficiently immobilizes the arm and prevents the movements of flexion and extension of the elbow, will answer the purpose.

This is the apparatus which I have used for several years. It is essentially the same that I employ for fracture of the clavicle (Fig. 3). It is a strip

of drilling, about a yard long, and a third of a yard wide, to encircle the body, the dimensions to vary with the size of the subject; to this are attached two suspenders as in the foregoing description; the body bandage is designed to be put on tight, and is provided with a pocket made by a fold in the drilling stitched to the bandage, and destined to receive the elbows.



FIG. 5. Apparatus for fracture of the arm, with the gutta-percha hollow splint for fracture of the middle of the humerus. The hand is supported by a suspender-strap, but the patient can remove the hand, and move the fingers from time to time.

A wedge-shaped cotton pad is placed in the axilla of the side, then the elbow of the member corresponding to the broken bone is adjusted to the pocket of the bandage; the bandage is passed firmly around the body behind and on the opposite side, and the end of the long segment is carried over the chest in front as far as and underneath the injured arm; the other segment is brought over the forearm which is applied closely to the chest and in such a way that the wrist is exactly on the middle line. The tail of this segment is attached to the bandage by three safety pins, two above the wrist and one beiow. The suspenders, which may be of elastic belting, are passed over the shoulders, and attached to the bandage above and below the forearm.

The dressing should be tight, and the suspenders should be so attached as not to draw up the limb too much. The capital point in the application of this bandage is to confine the arm closely to the trunk which serves as a splint.

With this simple apparatus, the patient can rise without inconvenience, and it is better that he should be on his feet than that he should be in bed. After the eighth day the patient may be allowed to walk about all day; the weight of the arm is a precious auxillary towards reduction of the fracture and its consolidation in a favorable direction.

The dressing should be kept on for thirty-five days. At the end of that time the callus is solid,

and the forearm is kept in a sling till the bone is sufficiently firm.

In simple cases, this apparatus gives very good results; in complicated cases it is no less advantageous.

You remember the syphilitic patient lately occupying Ward No. 6, who came in for fracture of the middle third of the left arm. The apparatus was kept on for three months, with ultimate good results. Fractures in the syphilitic are very slow to unite, by virtue of that law of pathology that every diathesis hinders the phenomena of normal reparation of the tissues.

Fractures of the middle part of the arm are those which are the least satisfactorily managed by any one of the apparatuses heretofore devised, and the retentive bandage which I have described does not fully meet the want. When there is a wound, and when the patient is obliged to remain in bed, a padded metallic hollow splint is very good, on condition that the bandages be daily tightened. But when there is no wound, and when the displacement is enormous, it is possible to keep the broken fragments in place by making a little addition to the bandage. Place above the apparatus another body bandage which shall confine the arm to the trunk from the shoulder to the elbow. This circular bandage, which is tightened every day during the twelve to fifteen days necessary for

the solidification of the callus enables us to obtain a good, regular, and just sufficient callus. In case your patient cannot bear the compression of the thorax, you can place around the arm a hollow splint of pasteboard or gutta-percha, representing three-fourths of a cylinder; this is made fast by an elastic strap, and then you apply the thoracic bandage in the way I have told you, taking care to interpose between the hollow splint and the trunk a layer of batting to prevent excoriations (Fig. 5). The pasteboard or gutta-percha splint prevents the incurvation of the humerus, so common after the application of a bandage.

In certain cases of multiple wounds of the superior extremity, you will find difficulty in well applying this apparatus, and there will result a rather more marked deformity of the arm; but I must warn you that in cases like some that you have seen, you cannot exercise compression on the arm to keep the fragments in place, on account of danger of causing disorders in case of a wound of the hand as grave as was that of the following patient:

CASE I. *Fracture of the Arm with Injury of the Hand*—Victor B., Feb. 17th, entered Cochin Hospital, Ward Cochin, for a fractu.e of the middle third of the left arm.

The apparatus with elbow and forearm pocket was adjusted according to the rules just laid down. But it was impossible to exercise a sufficient constric-

tion to keep the arm firmly fixed to the trunk; the inflammation of the hand obliged us to loosen every evening the bandage which had been tightened in the morning. Moreover, the hand was entirely free; no compression could be tolerated at the wrist. The thumb and index finger which had been badly bruised, and were dressed by occlusion, could not be kept in a dependent position; the patient was obliged to be on his back, and the hand was supported in a sling. Consolidation in the fracture was however effected, but the callus was deformed, the arm was incurved, and formed posteriorly a very apparent convexity. The immobilization of the upper member and of the elbow for six weeks had produced a rigidity which it was necessary to combat. On leaving the hospital, the patient could extend the arm so as to carry burdens. He had hardly had his discharge, when attempting to lift a pail of water, he again fractured the arm through the upper part of the callus. He returned to the hospital, and as the hand was now well, it was possible properly to apply the retentive apparatus, and make it tight. As the fracture was seated at the middle of the arm, we put on this time a figure of eight bandage. A hollow gutta percha splint, almost completely surrounding the arm, extending from the elbow to the axilla, was made fast to the arm by an elastic strap, and the ordinary fracture bandage confined the arm against the trunk; a pad of cotton batting protected the

thorax against the pressure of the gutta percha splint.

In five weeks recovery was complete; there was a solid callus, and the arm was perfectly straight.

The stiffness of the elbow had disappeared, for, as the hand was no longer painful, from the tenth day after the application of the bandage and splints, we caused the patient to exercise slight movements, then more extensive movements at the elbow joint. We had, in fact, but a simple fracture of the arm to deal with.

The patient entered the hospital April 16th and left May 20th, 1876. There was good bony union, and no anchylosis of the elbow.

In cases where there is a wound of the arm communicating with the fracture, the apparatus which I have described is excellent, but the wound must first be closed with strips of sticking-plaster. Dressing by occlusion is the only proper dressing in such cases, and the plasters should not be disturbed, for a renewal of the dressing would interfere with the necessary immobilization of the arm and the good bony union which you desire to obtain, besides being attended with pain to the patient. If abscesses form, they must, of course, be opened and the pus given free vent.

FRACTURE OF THE NECK OF THE HUMERUS, DIAGNOSIS AND TREATMENT

Fractures of the neck of the humerus are peculiar to subjects advanced in age, and have for their ordinary cause a fall on the tip of the shoulder or on the elbow. There is generally a displacement manifesting itself by a marked projection of the lower fragment, which is the shaft of the humerus impacted in the head of the bone. Sometimes the head of the bone is completely broken off and in the axilla. The displacement is often extreme, and is the more marked the nearer the line of the fracture is to the anatomical neck, or the more it involves the acromion. These fractures, especially when there are several fragments, are sometimes attended with enormous swelling, and are misinterpreted by even the most experienced surgeons, for when the swelling diminishes, they are often led into error by the projection in the anterior wall of the armpit, and look upon the case as one of dislocation.

The characteristic sign of the fracture is often absent. It is sometimes impossible to perceive crepitus by the ordinary processes, *i. e.*, by producing movements of rotation of the arm. But there is a very simple means of finding crepitus. You need only to exercise traction on the arm placed at right angles with the trunk while the latter is well supported, as in the reduction of dislocation, and during

these tractions, movements of rotation of the arm are performed. This is what takes place: The fractured surfaces which overlap each other are brought into juxtaposition during the tractions exercised on the arm, and rub against each other, giving distinct crepitus, which is not heard during rotation alone. When crepitus is heard, there is no longer any doubt, for if you sometimes hear cracklings in dislocations, these are absolutely different from the crepitus of fractures.

When you do not perceive crepitus, is this a proof that you have no fracture to deal with? By no means. The relative facility which one experiences in executing movements of rotation of the arm, although the patient suffers severe pain from such movements, and the swelling of the shoulder, which never exists to so intense a degree in dislocations, are sufficiently characteristic of fractures of the head of the bone.

The prognosis of fractures of the upper extremity of the humerus is not as grave as that of other joints. The most deformed callus never compromises the functions of the scapulo-humeral articulation, for the glenoid cavity is a shallow cup which allows extensive movements to the most irregular surfaces of a deformed callus; the infra-acromial hollow is large enough to accommodate a large callus, and give it a sufficient mobility. I have never observed scapulo-humeral anchylosis after fractures of the upper extremity of the humerus. Whenever the patients are

not rheumatic, the fracture gets well without leaving any trace. The movements of the shoulder joint are preserved almost intact, the power of lifting and of carrying the arm backward is alone a little limited.

In aged rheumatic patients, there is sometimes a consecutive dry arthritis. In the scrofulous, a white (purulent) swelling sometimes supervenes, but this complication is quite exceptional.

The treatment which you have seen employed half a dozen times a year in this hospital for the kind of fracture under consideration, consists in an apparatus of the simplest kind, whose sole object is to immobilize the arm against the trunk. It is especially in cases of fracture of the upper extremity of the humerus, that you will realize the truth of the proposition which I have enunciated, namely, that the secret of the successful treatment of a fracture is to prevent the muscular contractions which displace the fragments, and to keep the parts in relative immobility. We might treat fractures of the upper extremity of the arm by a simple sling, if the sling kept the arm firm while the patient was lying on his back; but as this is impossible, something more is needed. Twenty years ago, a popular way of treating this fracture was to surround the neck and shoulder with a spica bandage in order to fix the head of the humerus, but this bandage was always either too tight or too loose. Afterward, the same bandage was used, but it was starched or silicated. This retentive

method has been given up, and the hollow metallic arm splint, with a cavity for the tip of the shoulder, has come into quite general use. This apparatus, which is very good as long as it keeps well in position (which is seldom the case), does not give any better results than the simpler arrangement to which we now have recourse.

Our apparatus is exactly the same as that which we employ for fractures of the clavicle. We obtain with it an immobility of the shoulder joint as complete as possible, and we keep the arm in this position for a month. The position and weight of the arm favor the reduction. The fragments naturally come into place; consolidation is effected, notwithstanding an amount of displacement apparently enormous which was noted when the apparatus was put on. The reduction of the fracture is effected more perfectly than by tractions, the effects of which cennot be kept up by any bandage. At the end of thirty days, we place the member in a sling, and we daily perform passive movements; the patient himself has by this time already begun to use the arm somewhat, as the pain has disappeared, and thus convalescence is hurried.

When the apparatus for fracture of the clavicle is in place, it is a good plan to apply to the tip of the shoulder which remains uncovered, poultices of linseed meal. These emollient applications relieve the arthritis or hydrarthrosis which accompanies the

fracture, and hasten the resorption of blood effused, and this is still time gained.

Moreover, it is necessary to place in the armpit some cotton to prevent the excoriations which result from friction of the arm against the trunk; in fatty subjects or old women this is especially necessary.

It is a good plan also to place in the pocket of the broad bandage which supports the elbow a pledget of cotton batting when you have to do with lean subjects, in order to prevent excoriation of the skin of the elbow.

The recovery of the movements of the shoulder after the consolidation of the fracture, that is to say, after the first month, requires two months longer. When after this time has elapsed there is still pain and rigidity connected with the movements of the joint, it is because the patient has a dry arthritis.

During convalesence from fracture of the shoulder joint, there are often pains, which are alleviated by free painting with tincture of iodine every three days. Sometimes there is a paralysis of the deltoid, as is witnessed after dislocation of the shoulder. But this complication is far less frequent after fractures than after dislocations, and when it exists, it is to be treated like the paralysis consecutive to dislocations, by electricity.

CHAPTER III.

FRACTURES OF THE RIBS, FRACTURES OF THE PHALANGES OF THE FINGERS AND METACARPAL BONES, FRACTURE OF THE OLECRANON.

Of all the fractures which we observe in our hospitals, simple fractures of the ribs are the most frequent. We have an excellent mode of treatment for this kind of fracture, which works well even in very serious fractures. I shall presently give you instances in illustration.

The treatment of fractures of the ribs has always been by means of a circular band enveloping the thorax. From Verduc's buffalo corset to the ordinary towel used as a body bandage with suspenders attached, a great many different devices have been proposed which either do not hold with sufficient firmness, or are too tight, and all of which are intended to meet the indication: to restrain the movements of the ribs.

Malgaigne had the inspiration of genius and of good sense in suggesting the diachylon bandage, *i. e.*, a wide strip of sticking plaster capable of holding firmly by adhering to the integument. This is the only appliance which is sure to remain in place. Malgaigne properly reasoned that the ideal appliance for fractures of the ribs is a circular band which shall

prevent extensive movements during coughing, straining, and full inspirations, while not opposing respiration, and especially, the diaphragmatic respiration. He has, moreover, shown that it is not necessary that the fractured rib shall be pressed upon by the circular band, and that the compression exercised on the sound ribs above and below, in immobilizing these ribs, immobilizes also the fractured rib. These propositions are quite true, but there is a little qualification to add, as I shall presently show you.

The strip of diachylon designed to compress the thorax, as Malgaigne applied it, is three or four fingers-breadth in width, and extends once and a half around the thorax. I think that this width is altogether insufficient, and at our hospital we use much wider strips; we apply, in fact, around the chest, a strip of sticking plaster the width of an ordinary diachylon roll, *i. e.*, seven to ten inches, and we encircle the chest twice with it I always aim to make the middle portion of the diachylon band cover the seat of the fracture.

This strip of adhesive plaster holds well for a fortnight in the winter, and a week in the summer. Whatever may be the state of the respiratory passages, even when the patients are suffering from bronchitis and emphysema with dyspnœa, they have, as a rule, no difficulty in supporting this apparatus.

Ever since I have treated broken ribs in this way (and I have had fully four hundred cases the past

twenty years), I have but three times observed any complication obliging me to abandon the diachylon; these were herpetic patients with vesicular erythema, in whom the presence of the plaster caused intolerable itching. In one case I enabled the patient to bear the presence of the plaster by applying over the skin a piece of fine gauze and by placing over it the band of sticking plaster, taking care to have the latter overlap the strip of gauze above and below so as to keep in place. In many patients the diachylon produces a scattering eruption of little vesicles of erythema. This is far from being an evil, especially in patients that have bronchitis, for this rash causes a revulsion which has a certain utility.

It is easy to tell the degree of constriction caused by the plaster. Almost all patients feel relieved when the thorax is a little tight; and when they can cough without experiencing pain, and make a deep inspiration, it is best to leave the band just as it was when you put it on. In summer the plaster band must be made a little tighter than in winter, which causes the patients some inconvenience; the days which follow the first dressing the plaster gets loose and gives a little. On the whole, the patient's feelings are a good guide; if the constriction is too great, the strip of plaster must be taken off and put on more loosely. On one point I differ from Malgaigne, and think it better that the band should press upon the fractured rib. In fractures of the first three ribs by direct violence,

I apply the diachylon, not circularly, but in form of a double cross belt, and support the thorax besides by a circular band. Strips of diachylon are made to extend in the form of a spica from the two axillæ and overlap each other over the broken fragments; these are confined by a circular adhesive strip.

How long should the thorax be confined? From fifteen to twenty days; multiple fractures of the ribs do not demand a longer time than a simple fracture of one rib. It is rare that the plaster strips hold firmly all this time; when an adhesive strip gets loose, a new one must be put on in its place, and this is generally required at the end of a week in summer, and at the end of twelve days in the winter.

In fat women the diachylon band is difficult of application; in the lean it is quite easy. In women who have large mammary glands, it is necessary to employ strips of diachylon three fingers' breadth in width, and place them below or above the mammæ.

Fractures of the ribs complicated with displacement, and which are generally caused by direct violence, ought not to be touched. It is not well to endeavor to raise the fragments, for this reason: that they effect their own reduction, and that if in any case you reduce a rib really displaced, you cannot keep it reduced.

You will see by a case which I am about to cite, and which presents great interest, how disappointing are all attempts made to put back and keep in

place a displaced fragment, and what folly it is to try to reduce a fractured rib which cannot be kept reduced.

Whenever there is an overlapping of the fragmenrs of a rib broken in only one place, the first deep inspiration restores the fragments to their proper position. When there is a fragment of a rib separated from the rest of the rib by two lines of fracture, and retained only by a portion of the intercostal muscles—what is called a "floating fragment," —all that you can do to raise this fragment will be futile.

The incision of the thoracic wall, in order with the finger to raise the depressed rib, as proposed by Duverney, is a bad operation: First, because it is useless; and second, because you run the risk of a purulent pleurisy. The double blunt-hook of Goulard, the lever of Boettcher, the elevator of Collisen to take the place of the finger, are worth nothing. It is doubtful if any of these means have been really tried. I must add, that when there is a wound of the chest, you may and ought to raise the depressed fragments, and even keep them in place by suture of the bone if this is necessary. All the foregoing processes have always been advised for cases of fracture with depression of the fragments by direct violence; nevertheless, a fall on the back has sometimes caused a rib to snap in front, with sinking of one of the fragments. No forcible reduction is here needed; with resump-

tion of the regular course of respiration, the broken fragments come back into their place.

You have seen the specimen taken from a patient aged forty years, in whom one rib was fractured in two places; there was a laceration of the lung by reason of penetration of the thorax (without skin wound) by the shaft of a carriage. Death supervened the twenty-first day. The autopsy showed how a floating fragment becomes consolidated in a good position. The free portion of the rib which had penetrated the chest remained fixed to the rib below by the intercostal muscles; little by little it had come nearer to the rib, and a callus had formed between the sternal fragment of the rib and the floating fragment. The vertebral part of the rib had cicatrized by itself. The vacuity at the line of separation of the fragment from the rib which at the time of the accident could contain the fist was contracted so as not to exceed two finger's breadth. This specimen shows then that floating fragments of the ribs may little by little resume their place in cases the most complicated, without the necessity of manœuvres which are very dangerous when there is, as in this case, pneumothorax with effusion of blood and emphysema.

Emphysema without pneumothorax in fractures of the rib is due to a prick of the lung by the fragment of the rib at the moment of fracture. This emphysema is always limited to the thorax and sometimes to the neck, and undergoes resorption in the

course of a week; the nature of the wound, moreover, is such that it heals very rapidly. A few hours, in fact, after the prick of the lung, a little effusion of blood obliterates the wound and cicatrization is speedily effected.

Four times this year, from the first of January till the month of April, you have seen wounds of the lung by fractured ribs, and on three of these occasions there was no pneumothorax; the emphysema was always limited, and the patients got well. In one patient, seven ribs were broken, this was complicated with an external wound, and there was at the same time a fracture of the lower jaw; the patient made a good recovery. In the other three, where there were two ribs or only a single rib broken, the result was also satisfactory. In one of these patients, there were severe pains in the chest for more than a month and I had to apply dry cups; the patient spit blood, and there were marked signs of pulmonary congestion.

CASE I.—*Fracture of the ribs.—Emphysema.*—Joseph Miller, aged 65 years, workman in a quarry, entered Cochin Hospital, Jan. 5, 1876, for injury of the left side of the thorax caused by being struck by the spokes of a windlass. He was suffering from dyspnœa and severe pain in respiration. No spitting of blood. We detected fracture of the middle ribs on the left side of the thorax in their middle portion; there was slight emphysema of the lateral wall of the thorax. Wide adhesive strips were passed around the chest, over the fractured ribs. The emphysema took its course without ever extending far from the site of the fracture. Its limits above were the axilla and below the last ribs. On the 10th it had all disappeared.

No pneumothorax; râles of congestion especially at base

of left lung. After the 11th the patient was able to sit up all day. On the 24th he left the hospital, the treatment having lasted nineteen days.

CASE 2.—*Fracture of Ribs, with Emphysema.*—Patient, A. D., æt. 47 yrs., mason, entered the hospital, Feb. 21, for fracture of the fourth, fifth and sixth ribs in the left side, these ribs having been broken by a fall of three metres upon some small stones.

Pain and dyspnœa without hæmoptysis. No crepitation during cough, but severe pain; there was a depression over one of the painful points. Extensive emphysema of all the left side of the trunk as far as the lumbar region inferiorly, reaching to the left sub-clavicular hollow above; it even passed over the median line and gained the right mammary region. No pneumothorax. The left side was indeed more sonorous to percussion, but the vesicular murmur was well heard. Circular diachylon strips were passed around the thorax over the seat of fracture. Tenderness at base of thorax.

Feb. 22. Emphysema has extended as far as the groin, and above as far as the right sub-clavicular region.

Feb. 23-24. Condition not changed; dyspnœa less.

Feb. 25. The emphysema decreases rapidly.

Feb. 26. Emphysema nearly gone, patient sits up all day.

Mar. 12. Discharged; duration of treatment twenty-two days.

CASE 3.—*Fracture of Ribs. Emphysema.*—A. N., aged 49 yrs., slate roofer, entered Cochin Hospital, May 22, 1876.

At noon of this date he fell from the height of a second story, flat upon his back. He remembers nothing of what took place immediately after the accident. He did not recover consciousness until he found himself in bed in the hospital. At six o'clock the interne of the ward found him in a comatose state, from which he could be partially aroused. Respirations stertorous, incomplete; loud moist ronchi were heard at a distance. There were traces of blood in the mouth.

On exploring the right side where patient complained of severe pain, we were struck at once by a fixed crepitation, which was due to the emphysema; this emphysema occupied all the right lateral part of the thorax, from the root of the neck above to the abdominal wall below. In making pressure in the axilla over the first four or five ribs, the patient complained of severe pain. We felt at the same time a sink-

ing of the thoracic wall, as well as an evident crepitus from broken bones. The whole chest was sonorous to percussion. The vesicular murmur was not audible, it was masked by the emphysema. A large strip of diachylon was made to cover the fractured region. Dry cups were placed in the axilla and on the epigastrium.

May 23.—Had a good night; slept at intervals; no increase of emphysema. Evening: Dyspnœa has increased. Strong inspirations cause severe pain in the side. Since morning, bloody expectoration. The emphysema has gained the neck and the anterior abdominal parietes of the right side, as far as Poupart's ligament. Patient is always in a semi-comatose state, easily aroused; no frank vesicular murmur yet audible. Dry cupping repeated. Catheterization, as the patient cannot pass his urine. Axillary temperature 38.5° C.

May 24.—Patient has slept a little; bloody, viscous expectoration. In the evening, less prostration and dyspnœa; no change in the emphysema, which occupies all the right lateral half of the trunk. Patient expectorates with difficulty. bloody sputa. Has urinated. Axillary temperature 38° C.

May 25.—Same condition. Patient remains in dorsal decubitus; all movements are painful. Always a little dyspnœa, and bloody sputa. Emphysema diminishes.

May 26, 27, 28. 29.—Same condition.

May 20.—Emphysema has almost disappeared; bloody sputa lessening; dyspnœa less. Patient eats and sleeps better.

June 2.—Emphysema has disappeared. Still a little bloody sputa.

June 3.—A few rusty sputa; we yet scarcely hear the respiratory murmur, due probably to the immobilization of this half of the throax

June 7.—The patient improving; begins to sit up; complains no longer of pain in his side, except during full inspiration; no more emphysema or hæmoptysis. On auscultation, we hear on the right side friction sounds.

June 13.—Patient is in full convalescence. There is a callus over the 2d, 3d, 4th, and 5th ribs. The 2d and 3d ribs are glued together by a common callus. The strip of diachylon, which was renewed once, on the 16th day, is to be left on till it falls off of itself.

June 16.—Patient discharged well.

Pricks of the lung, by the sharp fragment of a rib, are rarely complicated with traumatic pneumonia; in order that an inflammation of this kind may supervene, something more than a simple prick is needed. You all remember that unfortunate patient who was brought to this hospital for fractured rib, where the shaft of a carriage had penetrated the thorax, breaking one of the ribs and producing contusion and laceration of the lung. A pneumo-thorax, then an effusion of blood, first menaced the life of the patient, then a sub-peritoneal abdominal emphysema with suppuration in the pelvis appeared along with a traumatic pneumonia with abscess of the lung, and finally purulent pleurisy, which carried him off.

FRACTURES OF THE PHALANGES OF THE FINGERS AND OF THE METACARPAL BONES.

Fractures of the Two Last Phalanges.—Fractures of the two last phlanges of the fingers, fractures generally accompanied with a wound, have ordinarily for their cause a violent wrench of the finger, and more rarely a blow. These fractures are ordinarily seated in the neighborhood of the joints. In young subjects, there is a separation of the epiphyses with fracture. These fractures almost always occur at the upper part of the phalanx. The displacement is always limited by the tendons; moreover, the periosteum is generally intact. Great displacements oc-

cur only when there are wounds of the integument and lacerations of the tendons.

Fractures of the phalanges are indicated by a swelling of the bone, by an ecchymotic appearance of the finger, and a mobility which is sometimes quite marked; but crepitus can only be detected by side-to-side movements, or movements of rotation. These manipulations are generally very painful. The crepitus soon disappears by reason of the promptness of repair of the fracture. It is rare that one perceives crepitus the fourth day after the fracture. The swelling of the phalanx, which then becomes more marked, is of itself a pathognomonic sign of the fracture.

Fractures of the phalanges are rarely followed by stiffness of the joints. As soon as the swelling of the fractured bone disappears—*i. e.*, at the end of a month —the finger resumes all its functions.

One quite common mode of treating fractures of the phalanges, is to bind three fingers together by strips of adhesive plaster; this method is only suitable for fractures of the middle and ring finger, and is a painful mode of treatment as the patients always exercise too much the sound fingers, and those fingers which are the most difficult to keep at rest are the index and middle finger. All the movements of these fingers disturb repair in the finger which is strapped to them.

The second method is, dressing by occlusion, similar to that employed in contused wounds of the

fingers. The finger which is the seat of the fracture is covered with several strips of sticking plaster, making a firm, hard dressing. When the adhesive plaster softens and becomes loose, it is removed, and new strips are put on. For thirty days the finger is thus dressed, and at the end of that time recovery is complete. This treatment is very mnch better than that by splints placed on the finger, for splints of whatever material can only be kept in place by tight strapping and bandaging, and this constriction is very painful.

The treatment applicable to fractures of the fingers is also applicable to fractures of the phalanges of the toes and metatarsal bones; for fractures of the metatarsi, the foot should be covered with a layer of wadding, and a silicate bandage applied over the whole.

Fractures of the First Phalanges.—Fractures of the first phalanges of the middle and ring finger have a tendency to displacement forwards. Fractures of the first phalanges of the index and little finger have less tendency to forward displacement—the displacement is generally lateral. In fractures of the first phalanx of the thumb, there is generally little or no displacement.

All the indications of treatment depend on the knowledge of the tendency to the habitual displacement.

To fractures of the first phalanx of the index and

middle fingers, the best method of treatment consists in surrounding the entire finger with strips of sticking plaster, and a simple bandage applied spica fashion. To prevent this dressing from getting loose, the tails of the adhesive strips are made to go down the back of the hand, and are confined by means of a few turns of spica bandage from the hand and wrist.

Fractures of the first phalanx of the middle and ring fingers are treated like those of the corresponding metacarpal bones.

Fractures of the Metacarpal Bones.—Fractures of the metacarpal bone of the thumb and little finger may be treated by a spica from the thenar and hypothenar eminences, made with strips of adhesive plaster, and confined by a spica bandage from the metacarpus and wrist. The displacement of the fractured bones when there is no wound is always but little marked; the muscles which are inserted into the metacarpal bone keep the fragments sufficiently in place, and the dressing has only for its end to limit the movements of the hand which are apt to be painful, and to prevent deformity of the callus.

Fractures of the metacarpal bones of the index, medius, and ring fingers, when there are no evident displacements which would be augmented by the movements of the fingers, may be treated by a simple bandage; this does not prevent the patients from using the fingers which correspond to the uninjured metacarpals. You will place in the palm of the hand a

compress of wadding, and confine it by a spica bandage from the wrist and metacarpus, and this is kept firm by strips of adhesive plaster passed around it. You should avoid the use of pins in dressings about the hand. The above is Sir Astley Cooper's method.

When the displacement of the second, third, and fourth metacarpals is very marked, and especially when the fracture is seated at the condyle of the bone, to prevent displacement and to obtain good consolidation, you may treat the fracture in this way: Place in the hand a wad of charpie or of cotton batting, the size of a small egg. Make the patient close the hand, leaving the thumb free; confine the hand, thus shut, with a dry bandage two fingers' breadth in width. When the hand is thus bandaged, pass around the whole several strips of sticking plaster of the same width, and leave on this dressing a fortnight. At the end of this time the dressing is replaced by a spica bandage from the wrist and metacarpus; this is kept on a fortnight, after which time the patient may use his hand.

This dressing is just as suitable for fractures of the first phalanx of the middle and ring fingers, as for fractures of the metacarpals.

For fracture of the metacarpal bone of the thumb, the best dressing is a plaster spica, kept in place by a few turns of a cotton bandage; this dressing is kept on for a month.

In no case do I advise you to apply the wooden

splint called the finger palette, for fracture of the phalanges and metacarpals. The principal fault to find with the palette is that for fractures of the metacarpal bone of the thumb it is worth nothing, for it only supports the fracture on the side where it has no tendency to become displaced. It is always posteriorly that the inferior fragment projects, and the palette compresses only the palmar aspect of the bones. For fractures of the second, third, fourth and fifth metacarpals, it is necessary to place a compress of wadding between the palette and the palm of the hand. With this apparatus you immobilize the fingers in extension, while with the dressing which I prefer, the fingers are kept flexed, and in this latter case you avoid the stiffness of the fingers which always results from confining the fingers a month in extension; this certainly is an advantage. For all fractures of the fingers and metacarpals complicated with wounds, other methods of treatment are necessary: large contused wounds of the hand, with fractures should always be treated by continuous irrigation, and contused wounds of the fingers with fractures, by the dressing by occlusion.

FRACTURES OF THE UPPER THIRD OF THE ULNA. CONSECUTIVE LUXATION OF THE UPPER EXTREMITY OF THE RADIUS IN FRONT.

Fracture of the ulna at its upper third is always produced by a direct cause; a fall on the step of a stairway, for instance, or a blow from a cane.

I have seen two cases, where the fracture resulted from a fall against the edge of a pail; in one case the patient struck the lower part of the olecranon against the round of a ladder. This fracture is quite rare, but should be well understood, for it is generally complicated after recovery by an annoying subluxation of the radius; of the danger of this accident you should in due time apprise your patient, especially when you are likely not to be able to prevent the production of this deformity.

The fracture of the upper third of the ulnar by direct cause is an irregular oblique fracture; sometimes, though rarely, there are three fragments. The immediate displacement is considerable; you feel a deep hollow in the site of the fracture and sometimes there is at this point an abundant effusion of blood.

The upper fragment is drawn up and out by the triceps, and there is both riding and angular displacement. The separation of the fragments in a longitudinal direction is not great by reason of the persist-

ence of the interosseous ligament and of the radius which serves as splint.

The displacement is, however, sufficient to cause during consolidation a projection of the provisional callus which crowds the radius forwards, and after the period of resorption of the provisional callus, a shortening of the ulna of about a centimetre. Theoretically you already conceive the consequence of this shortening. From the moment that the shortening takes place, one of the extremities of the radius must be displaced, for it cannot possibly undergo incurvation. In fact the lower extremity of the radius, united to the ulna by the powerful triangular ligament, which is an interosseous ligament and strengthens the radio-cubital articulation, cannot become displaced. On the other hand, the upper extremity of the radius, united to the ulna by the relatively lax annular ligament which is capable of stretching, is more readily displaced. Add, that the condyle represents three-fourths of a sphere, on which easily glides the border of the cup-shaped extremity of the radius, and that this favors gradual displacement. Displacement here, in short, is the rule rather than the exception.

Luxation of the upper extremity is first outward; it is at the end of the first month after the fracture that the dislocation begins to manifest itself in a very gradual manner. The movements of pronation and supination are at first a little impeded, then flexion of the forearm on the arm cannot be performed com-

pletely; the flexion of the forearm scarcely exceeds a right angle. Lastly, if you examine the region of the elbow you notice the very appreciable projection of the head of the radius, which rolls under the finger during the movements of pronation and supination. From the second to the third month, the luxation has attained its maximum extent. There is a deformity appreciable to the eye, and you find on digital examination all the characters of luxation of the upper extremity of the radius outward and forward.

To sum up, there is an outward dislocation of the radius, but as time advances the luxation changes somewhat in character; the head of the radius is carried a little forward, so that you have all that is signified by the words *outward and forward luxation.*

It is only the fractures of the upper third of the ulna that are followed by gradual luxation of the upper extremity of the radius. Fractures of the middle and inferior third do not cause this sub-luxation. These fractures are easily reduced and kept in place.

I observed the first case of this kind in a lady of Boulougne, in 1867. The fracture had been caused by a fall on a stair step, the elbow striking heavily against the border of the step. Seat of fracture—just at upper third of left ulna. A dorsal splint was first applied, then a palmer splint the whole length of the ulna, and both were kept in place by strips of adhesive plaster; the hand was confined at right angles in

and augment the annular displacement of the two fragments. It is only from position that we can expect anything, and this is the forced flexion of the elbow.

Forced flexion maintains the fragments in juxtaposition, and produces a coaptation which we cannot obtain by any other means. It best keeps the arm bones apart, for the triceps, by pulling on the olecranon, tilts the upper fragment, prevents the anconeus muscle and the extensors of the fingers from drawing the upper fragment outward, and keeps it in contact with the lower fragment.

A patient recently in our hospital service had a fracture of the upper third of the olecranon. We applied with good results what I regard as the rational treatment of this fracture.

Fracture of the upper third of the ulna; recovery without luxation of the radius.—Leclerc, aged forty-eight years, fell on the elbow Feb. 17th, 1876, striking a stairway and breaking the ulna at its upper third.

On examining him, we found an ecchymosis and a thrombus just below the olecranon; there was a fracture with depression of the upper fragment, and the movements of pronation and supination caused crepitation. The fracture was oblique, the direction being downward and outward.

The arm was kept in a sling, and the patient entered the hospital Feb. 21st, 1876. M. Després made use of the following retentive apparatus: A trian-

gular strip of sail-cloth was folded so as to leave a trough-like depression in the middle, and applied like a soldier's belt so as to include the injured forearm and elbow, being passed up along the front, over the opposite shoulder and down the back where one tail was made secure to the other by means of safety pins. (See figure 6.) The forearm and elbow were placed



FIG. 6. Shoulder belt sling to maintain the elbow in flexion.

inside the trough-shaped cavity, and the edges were brought together with pins placed along the forearm so as to keep the limb well confined. The forearm,

as is seen in the figure, was brought up in a state of flexion so as to touch the tip of the opposite shoulder. A pad of wadding was placed in the axilla to prevent friction from causing an erythema; a compress was also placed in the bandage under the olecranon to prevent the pain caused by the permanent pressure of the bandage on this bony prominence.

The bandage was somewhat painful to the patient, who did not rest well the first three nights. There was some numbness in the hands, due, doubtless to pressure on the ulnar nerve, as it was the little finger and ring finger that were chiefly numb. When the bandage was slackened a little, the patient felt relieved. Six weeks after the accident, the patient went out, quite well, without any trace of luxation, and with almost complete freedom of movements of the elbow. The result, then, has justified our previsions, and the forced flexion of the forearm has enabled the fractured bones to unite without the usual deformity. The line of fracture was marked by a faint linear projection; consolidation was as perfect as possible. There was no apparent callus.

Two months after the discharge of the patient, he returned to report himself as perfectly well, with no luxation or inconvenience whatever from the fracture.

The treatment here indicated has certain inconveniences which should be known in order to be remedied. The distention of the ulnar nerve causes

a numbness of the last three fingers. This is relieved by making the patient sleep on the side opposite to the fracture of the forearm. On the twentieth day the dressing should be loosened somewhat, the hand is left free and the numbness disappears.

As the band must be very tight, the batting between the elbow and the sheeting will be found to be important.

CHAPTER IV.

TREATMENT OF COMMON FRACTURES (Continued) — FRACTURES OF THE THIGH — CHOICE OF APPARATUS — APPARATUS OF HENNEQUIN — THE AMERICAN METHOD, ETC.

FRACTURES OF THE THIGH.

Velpeau * has shown that with a shortening of several centimetres (not exceeding an inch and a half), patients do not limp. It is not, then, a matter of the highest importance to prevent all shortening after a fracture of the thigh. But while admitting that Velpeau's statement is correct, there are cases where shortening in fractures of the thigh may attain disastrous proportions, and where, in the sequel, the patients, in order to walk comfortably, are obliged to wear shoes with very high heels. In these conditions, patients limp very perceptibly. Limping ought to be prevented as far as possible, and for this reason we ought, according to the case, to employ that apparatus, whether simple or complicated, which will give the most perfect consolidation with the least shortening.

During the last century, surgeons employed Potts'

*Velpeau, *Shortening in Fractures of the Thigh* (*Gaz. des Hospitaux*, 1861).

double inclined plane, then Desault's apparatus. At the beginning of this century, Boyer adopted the Desault splint. Since then, a great number of appliances have been devised for fracture of the thigh, such as: Bauden's fracture box, the suspension splint of Shrimpton, Bonnet's trough for fractures of the upper part of the femur; lastly, Nelaton has brought into vogue the American long splint. Each of these means has a certain utility, and is calculated to meet certain ends.

The really good apparatuses for fractures of the thigh are: Bonnet's trough, Hennequin's splint, and the American long straight splint. (Fig. 7.)

Bonnet's hollow splint is peculiarly a French-hospital apparatus. It is a mould of wicker-work, closely adjusted to the limb, enabling one to treat fracture of the thigh by simple position. A perineal belt and body bandage may be added for counter extension, and continued traction may be exercised on the broken limb by means of a weight attached to a cord which is made to pass over a pulley in an upright at the foot of the bed.

Hennequin's splint * is a more complicated

[* Hennequin's apparatus, which is a complicated and costly one, but is highly spoken of by M. Després, is a hollow frame furnished with two iron beams. At the upper extremity of the frame are fixed movable iron rods provided with stuffed pads designed to be applied to points of the bony pelvis; thus a pad presses on the pubes, another on the

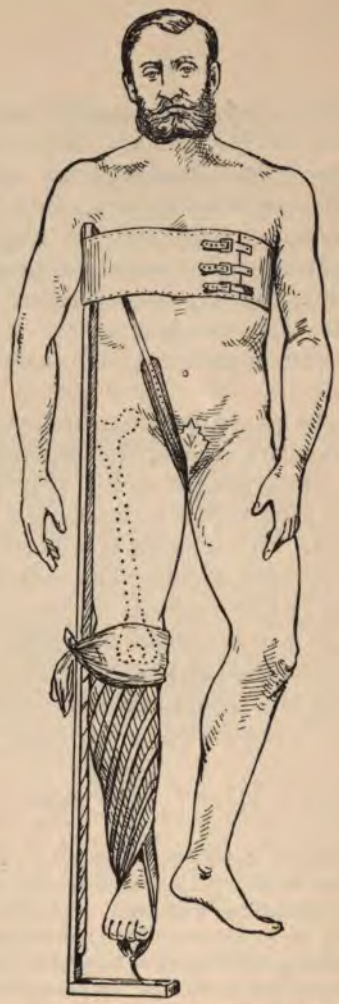


FIG. 7.—Long splint for fractures of the thigh.

affair. [The Translator has taken the liberty to omit the long descriptiou in the text of Hennequin's apparatus, for it is difficult of manufacture and expensive; moreover, there is danger of harm resulting from the use of this apparatus from pressure of the numerous pads on the bony prominences of the pelvis; eschars, according to Desprès, have been not infrequently produced.]

[One of the best apparatuses for fractures of the thigh is Dr. N. R. Smith's anterior splint, described in Gross' Surgery (fig. 8). It consists of a single

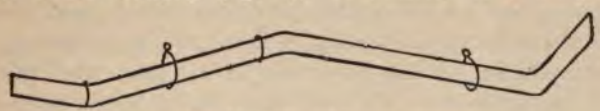


FIG. 8. Dr. N. R. Smith's anterior splint.

ischion, another on the anterior superior spinous process of the ilium. Thare is a series of screws and grooves for changing the position of the pads in order to adapt the apparatus to the form of the patient. In adjusting the splint, the pads are first adapted to the parts of the bony pelvis to which they belong. A roller bandage is applied to the leg and the lower part of the thigh. Over this bandage at the lower part of the thigh, by means of a few turns of a silicate bandage is fastened a couple of adhesive strips, to each of which is attached a short cord for purposes of extension; these are passed through the holes in the iron beams, one on each side, and attached to the upright, or else they end in a six to twelve pound weight, The leg is flexed on the thigh, and in order that the patient may remain recumbent in his bed, the leg must rest out of the bed, the foot being supported on a chair. This apparatus makes a continuous extension, the maximum effect of which is exerted on the thigh, just where it is most needed.]

piece made of wire of the size of a No. 10 bougie, and bent at each extremity, the whole representing the form of a long parallelogram, three inches wide above, and two inches and three-quarters below. It must be long enough to reach from a point a little above the anterior spinous process of the ilium to an inch beyond the toes, when the thigh, leg and foot are extended, three feet eight inches being a good average length for adults. The side pieces are firmly connected by cross pieces at a distance of about eight inches. Thus constructed, the wire splint is easily bent to suit the case in hand. The angle at the tibio tarsal joint, six inches from the extremity, is about 120° to secure an easy posture for the foot; that at the knee and the hip are each about 160°, the latter being about seven inches from the upper extremity.

The splint properly padded, or tightly wrapped with a Martin bandage, and secured to the limb by a roller extended from the toes upward, is suspended by means of a pulley cord and loops to the ceiling, a compress being placed upon the instep and another upon the groin to ward off pressure. The proper position of the hooks is a matter of great consequence. In general the upper one should be attached nearly over the seat of the fracture, and the lower a little above the middle of the leg, the object being the thorough equalization of the pressure of the splint. The roller confining the apparatus should be well stitched to prevent it from slipping, and great care

taken that it does not make undue constriction. This apparatus is exceedingly light and comfortable, and is equally well adapted to fractures of the thigh and leg in every portion of their extent.*]

[An excellent mode of treating fractures of thigh, attended with very gratifying results, is that of Dr. Gurdon Buck; it is the method pursued at the New

* While the above text was going through the press, the Translator received the following criticism of the above description by Dr. G. Archie Stockwell, of Detroit, Michigan.

"The splint as described by Gross is too small, and the above cut is misleading. I have usually employed one slightly wider than the leg to be treated—wider at the thigh than at the foot—and long enough to reach from the anterior superior spinous process of the ilium to three inches beyond the toes. (Fig. A.) This is swung by means of hooks, pulleys, and a stout cord, to a hook in the ceiling, or to a framework attach-



FIG. A. Stockwell's Modification of Smith Splint.

York Hospital.† The long splints are entirely dispensed with, the extension being made by the action of a weight and pulley, and counter extension by the

ed to and over the bedstead. (Fig. B.) The splint should be made of the stoutest $\frac{8}{16}$ steel wire, and braced at least three times in its length—once near the knee, once at the



FIG. B. Bed and Frame for Suspension.

groin, and once at the ankle; the hooks to suspend it are also made of stout steel wire, (Figs. C. or D.) embodying a self-closing spring to prevent slipping; one of these is hooked behind the brace over the groin, the other in front of that at the ankle, and the two are connected by a cord, in the centre of which, by a loop that will permit



Fig. C.



Fig. D.

† Gross' Surgery, Vol. 1, p. 1034.

usual perineal strap lengthened out and fastened to the head of the bedstead. A piece of adhesive plaster from two and a half to three inches in width, is stretched along the sides of the limb, to a short distance above the knee and confined by a roller extending from the toes up, the middle of it forming a loop below the sole of the foot. A thin block of wood the width of the plaster, and long enough to prevent pressure over the ankle, is inserted into the loop, and thus serves to receive the extending cord, which is fastened to an elastic rubber band passing around the block, and playing over the footboard of the bedstead. The thigh at the seat of the fracture is surrounded with short splints, the heel is supported upon a thin wedge-shaped hair cushion, and a bag filled with sand or

to run free, is attached the cord that suspends from a pulley attached to a hook in the ceiling, or frame-work before mentioned. This second cord passes through a hole in a bit of board (fitting snugly), and after going over the pully returns to this board or block, and passes through it downwards, and again upwards, which prevents slipping—(Figure E).

In applying, strips of bandage of proper length are slipped under the injured limb, side by side, from the heel to the upper portion of the thigh; the ends of these are next folded over each side of the splint and fastened back upon the ascending portion by 1, 2, or 3 safety-pins, as may be required by the width of the strip and to keep the whole smooth beneath the limb; now the hooks are adjusted and the



Fig. E.

bran is placed along the outside of the leg and foot to prevent rotation. The amount of weight to be employed must be determined by the age of the patient,

limb hoisted free from the bed. (Fig. F). Once the

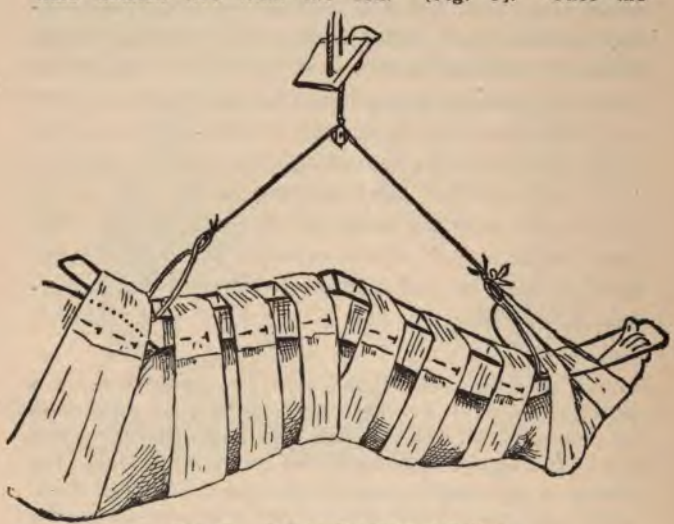


FIG. F. Leg in Cradle and Splint.

Note.—The engraver has made a mistake in this cut, since he represents the bandages as passing over the *top* of the splint, when in fact each strip is pinned by its ends to *each side* of the splint. Also a greater number of pieces of bandage will be required than is here represented, since they should be so close together as to form a *continuous* trough or cradle, and at the same time narrow enough to be smooth and exert even pressure; they may even overlap one another. Further the leg should have greater flexion at the knee—nearly 35°. It may be remarked also, that the sole reason of giving an upward bend to the distal or foot end of the splint, is to afford support for bed clothing so that the weight thereof will not come on the toes. At A (Figure) the broad body bandage is attached.

Again the representation of the fastening block is incorrect; see instead Figure.

and the other circumstances of the case. A child under eight years of age will seldom require more than five or six pounds, while an adult will require from fifteen to twenty. The most suitable perineal band is a piece of Indian-rubber tubing of one inch calibre, two feet in length, with a ring at each end, stuffed with bran or cotton lamp-wick, and covered with Canton flannel wrapped spirally around it, and renewed whenever it becomes soiled.]

The American splint is a modification of and improvement on Desault's apparatus.

It consists in a long splint extending from the

limb is up, any re-adjustment deemed necessary, either for comfort, or to insure exact approximation of the fractured ends of the bone, can be attended to. This leaves the limb in a sort of cradle, constantly under the eye, since, if it is a simple fracture, there are no other splints or bandages. If the splint is bent sufficiently at the knee, there will be little if any shortening in fracture of the thigh, the weight of the leg, and contra-weight of the body being ample for all purposes of extension. I should have mentioned, also, that a broad bandage encircles the hips, and is fastened to the upper end of the splint; and that a bandage supports the sole of the foot being fastened to the lower suspension hook.

"The especial advantages of the splint are: 1. The seat of fracture is always under the eye. 2. Any change or re-adjustment is accomplished simply by relaxing or tightening one or more strips of bandage. 3. No trouble from swelling or erosions. 4. Comfort to the patient, who is able to move about the bed, or sit on a chamber, commode, or bed-pan; the injured limb is immovable save at the hip joint. 5. The

axilla to about ten inches beyond the foot of the patient, lying lengthwise in bed. This splint has the merit of being simple; any carpenter can make it. The upper part of this splint is confined by a pocket in the body bandage; the latter is made of strong drilling, and made fast to the thorax by means of straps and buckles. At the lower extremity of the splint there is an iron hook to which the cord may be fastened by which extension is made. At the upper part of the splint, above the body bandage, there is a

patient may himself elevate or lower the leg, regulating the position to meet the demands of comfort. The greatest trouble arises from difficulty, at times, in keeping the limb warm, but folded flannels may be laid within the cradle on the leg, and bed clothing can be made to cover like a tent by suspending from the cord that supports the splint. In compound fractures, especially of the shaft of tibia or femur, this splint is simply invaluable, as wounds can be readily dressed, one end of one or more bandages being dropped for the purpose, as desired.

"I don't know what I would have done, in one notable case, but for this device. It was a compound comminuted fracture of the femur above the condyles—two inches of the bone ground to fragments, and the condyles split apart; there were also two large wounds, either the size of a silver dollar, on the interior posterior aspect of the thigh. In this case, Smith's anterior splint saved the man from an amputation, and gave him a leg every way serviceable but for shortening—the only case of shortening I ever had with this splint—which, of course, was to be expected; shortening only amounted to 1¼ inch. I always bend the splint at much more acute angles than are represented in your cut, placing the leg in much the

hole for the insertion and attachment of the perineal belt which may be of India rubber, or some padded material, and which enables the surgeon to make counter extension on the pelvis.

In applying, the surgeon places on the internal aspect of the splint a long narrow cushion or wad of cotton batting to protect the limb from pressure. The body bandage is then put in place and buckled.

To make extension, cut several strips of sticking

same position as with the double-inclined posterior splint. My brother, Dr. Charlie B. Stockwell (Harvard, 1878) took this splint as the theme for his graduating thesis, and found the device was not at all understood in B)ston, which is the ground for the liberty taken in writing you, for which I trust you will pardon me. J. Collins Warren subsequently employed it, with 'profound satisfaction.' But I was amused, not long afterwards, upon seeing a paper in the Boston *Medical and Surgical Journal*, written (I think) by a house surgeon of the Massachusetts General Hospital, in which he took up the idea and elucidated a plan (wholly superfluous) of applying extension to the foot as it rested in the cradle, by means of braces to fasten to the foot-board of the bed, and pulleys and weights.

"My first introduction to the splint was through my father, Dr. C. M. Stockwell, of Port Huron, Mich.; and the first I applied was one furnished among U. S. Army hospital stores at Fort Gratiot. This was the original Smith, of the dimensions given by you, but proved entirely too small for ordinary purposes. Last year my brother and self applied two of these splints in a case of fracture of both legs, with perfect success, and were surprised at the amount of tumbling about the patient was capable of indulging in without pain."

plaster, about two yards long, and an inch wide. Cut eight or ten of these strips, and apply them lengthwise to the limb beginning with the thigh, passing down in the form of a long spiral over the bottom of the foot where a loop is left free, then passing up the leg on the opposite side, then up the thigh, care being taken to form an ascending spiral in a direction opposite to the first. Eight of these strips are thus passed down and up; they are applied at a little distance from each other, so that the inferior part of the thigh and the leg are almost covered by them. You have then under the sole of the foot a cord representing the place of union of all the free loops of the adhesive strips.

The splint is then engaged in the pocket of the body bandage, the perineal belt is adjusted, and its free extremity passed through the hole in the top of the splint and made secure.

Extension is made in this way: A cord is passed through the loop in the sticking plaster; firm, steady traction is made on the limb, and the cord is fastened to the hook in the foot-piece of the splint. The Americans employ a screw arrangement by which extension can be increased or diminished at pleasure. Several elastic straps, or even handkerchiefs, folded cravat-fashion and passed over the knee and calf, fix the splint to the inferior extremity.

This apparatus should be tightened every day for the first thirty days.

One of the great advantages of traction thus obtained is the diffusion of the force. Other contrivances for continuous extension consist of circular turns of bandages which are tight and likely to cause eschars. Here, there are no circular bands, and the diachylon draws at once on all the points to which it sticks. I have often observed eschars in patients on whom Velpeau had been making continuous traction from the ankle, the extension being made from a spica encircling that joint. I have only once observed an eschar caused by the pressure of the loops of diachylon in the sole of the foot.

The American splint is designed to effect continuous traction; this requires extension of the limb, and ultimately entails stiffness of the knee joint; in this respect it is inferior to Hennequin's apparatus, [or the long anterior splint of N. R. Smith.] And although the latter immobilizes the knee in flexion, yet stiffness of this joint is as rare after flexion as it is frequent after prolonged extension.

One may, however, when using the long splint somewhat alternate the effects of prolonged extension by making passive movements at the knee joint after the twentieth day; this can be done without deranging the apparatus. The hand is passed under the joint and moderate flexion and extension are made. It is best not to be in too great haste to apply the starch or silicate bandage, as this renders such passive movements difficult, if not impossible. The

worst kind of retentive apparatus for fractures of the thigh are the plaster, silicate, or other immovable splints, when put on early.

Lefort has constructed an apparatus which is much in use; it is a double inclined plane of sheet-tin and of iron, which is handy, but is not always available to the practitioner in small towns and cities.

[The double inclined plane is a good method of treating fractures of the body of the femur. The limb is placed upon two grooved cushions resting upon two pieces of board, united by hinges in the form of a double inclined plane, and long enough to extend from the tuberosity of the ischium to the back part of the heel. The limb is first bandaged from the toes to the groin; two light, but firm, binder's board splints are secured to the outer and inner parts of the thigh, meeting nearly in front, and reaching from the groin to the knee. The extremity is now laid over the inclined plane in an easy, comfortable position, the angle of flexion having special reference to this point; the foot is attached to the foot-board, and the limb and plane being tied firmly together by tapes, or a bandage, the dressing is completed.

In this splint, extension is made mainly by the weight of the leg and foot, while the counter extension is made by the pressure of the apparatus against the tuberosity of the ischium. The double inclined plane most in use in this country is the McIntyre splint.]

Is there any apparatus which can take the place

of Bonnet's trough splint? I am inclined to answer this question in the negative. For all intra and extra capsular fractures of the neck of the femur, this is *par excellence* the apparatus. Hence every surgeon should be provided with one of these splints.

You are not to expect consolidation in intra-capsular fractures. It will not do to make prolonged traction on the legs of old people, for fear of causing eschars, nor will it do to keep such patients long in bed; they lose their strength, and are very likely to fall victims to pneumonia, or other diseases peculiar to infirm and bed-ridden old subjects.

For the first fortnight, Bonnet's trough splint renders inestimable service. There is no great difficulty in attending to the functions of urination and defæcation without disturbance of the fracture or causing pain. The pains which aged patients experience on being moved, become materially lessened after a fortnight. These patients should not be kept in the hollow splint longer than a fortnight, else there will be sloughing about the heels and ischia.

After the first fortnight is over, there is no longer need of confining the limb. A board is placed under the first mattress, in order that patients may not sink down in their bed; on the thirtieth day they are allowed to walk with crutches; a little later they may be allowed a cane, and about the third month these patients can generally walk quite well; there will be a shortening of about an inch, and the foot is rotated outward.

In extra-capsular fractures of the neck of the femur, where consolidation can be obtained, Bonnet's splint is still an excellent appliance. These fractures generally pertain to patients of a less advanced age. Patients may be kept in this splint twenty days, and if there is great shortening, extension and counter extension should be made. A padded perineal belt should be well applied and fixed to the upper part of the splint, and continuous extension by means of a pound weight made from the foot. The cords for making extension are attached to a starch bandage which envelops the leg. At the end of twenty days, traction is suspended, and the patients are left ten days longer in the trough splint. After this, they are left in their bed without any splint, a board being put under the first mattress. The sixtieth day the patients are allowed to sit up, and in three months they are able to walk with a cane.

[One of the best methods of treating fractures of the upper part of the thigh in old people is by the fracture bed. The kind most generally in use is Jenk's fracture bed.

" It is composed of two upright posts about six feet high, supported each by a pedestal; of two horizontal bars at the top, somewhat longer than a common bedstead; of a windlass of the same length placed six inches below the upper bar; of a cog wheel and handle; of straps secured at the end of the windlass, and at the other, having hooks attached to corre-

sponding eyes in the linear belts; of a head-piece made of netting; of a piece of sheet iron twelve inches long and hollowed out to fit and surround the thigh; of a bed pan, box and cushion to support it, and of some other minor parts." (Gross' Surgery, vol. 1, p. 1030.)

Gross finds the most convenient and suitable apparatus for children to be a case made of stout, unoiled sole-leather long enough to extend from the groin to an inch and a half below the heel, and sufficiently wide to come well around the limb, especially the thigh. It is supplied with a foot piece of the same material and is well padded at its upper extremity to prevent undue pressure upon the perineum. The outside portion of the trough is continued for some distance over the hip, to which it is secured by a spica or common roller carried around the thighs and pelvis. A splint also of leather, gutta-percha, or thin wood is stretched along the fore part of the limb from the groin to the patella, wadding being suitably interposed to ward off pressure; the apparatus is held in place by an ordinary bandage, adhesive strips having been previously secured to the leg and attached to the foot piece. The dressing is completed by placing the limb, with its apparatus, in an easy position upon a hair or cotton bolster, gradually tapering upwards, its thickness below not exceeding four inches. By this simple contrivance, the requisite extension and counter extension are obtained, the perineum affording a *point d' appui* which effectually pre-

vents ascent of the apparatus while the foot piece serves to keep the foot in place, at the same time that it receives the extending bands.]

Fractures of the lower half of the femur are the most common; they are likely, as ordinarily treated, to get well with a trifling amount of shortening. These fractures do very well when treated by the long straight splint.

Put a board under the mattress, before applying the splint; in order that the knee may not become stiff, place a cushion under the joint, and thus keep the leg slightly flexed. Every day, tighten a little the cord by which extension is made, and re-apply on the thigh the strips of diachylon that may have become loosened.

The chest bandage, to which is fixed the upper part of the splint, should not be loosened during the first twenty days, and the patients must be kept very quiet with the whole body in extension. After twenty days, the chest bandage may be opened during meals so that the patient may enjoy his repast in a sitting posture. The perineal band should be loosened while the patient is sitting up in bed.

The long splint should be kept in place for forty-five days. But after the fortieth day, it is desirable with the hand to make movements of flexion and extension at the knee-joint.

If the fracture is consolidated, a silicate bandage may be put on and kept on for a fortnight; on the

sixtieth day, the patient can dispense with all retentive apparatus.

The great evil attending all apparatuses requiring continuous traction, the limb being in extension, is the consecutive stiffness of the knee-joint; in aged and rheumatic subjects this cannot be avoided; in young subjects this evil is reduced to a minimum by massage movements made every day after the twentieth while the limb is in the splint; although these movements are of very limited extent, they are of unquestioned utility in preventing stiffness.

[From the foregoing text, it will be seen that the variety of retentive apparatuses for fractures of the thigh is considerable. For vigorous adults with good reparative power, the long splint (Liston's), or some modification of it, is a convenient and reliable apparatus, and most surgeons use this in their daily practice. If properly applied, it gives good results, with but little shortening. An inch or an inch and a half of shortening is no great inconvenience; persons with an inch and a half of shortening are able to walk with scarcely any appreciable limping. This splint, however, is not good for fractured neck of the thigh in old people. It keeps the patient's body and limbs in a perfectly straight line, preventing any movement of the member, so that we are often obliged to leave off the splint or relax it to change the position of the patient for purposes of cleanliness or comfort; or, as often happens, the breathing becomes

affected, and the patient requires to be placed in a sitting or semi-erect position, and we must again relax the apparatus. The perineal band is also a source of suffering, inflammation, ulceration, or even sloughing taking place beneath it.

Hence, in such aged patients the long splint has to be abandoned for the fracture bed, in which bags of sand along the thigh and leg may be made to take the place of splints. In using the fracture bed, a moderate extension can be made from the foot by means of a cord attached to the foot bandage, made to play over a pulley in an upright at the foot of the bed, and connected with a five to ten pound weight. In intra-capsular fractures, the utility of all extension is doubtful.*

Dr. William Colles, in Braithwaite's Retrospect, Part 66, page 108, speaks favorably of a modification of Sayre's splint for morbus coxarius, which he has employed with advantage in fractures of the upper part of the thigh. For a description of Sayre's splint, see Braithwaite, Part 64, page 112 (Am. ed.).—TRANSLATOR.]

*One of the best appliances for intra-capsular fractures of the neck of the femur in old people, is the Daniel's fracture bed. The bed is so arranged that while the patient can sit up, or vary his position, efficient extension and counter extension may be maintained by adhesive strips. Daniel's fracture bed is in use in many of our hospitals.—TR.

CHAPTER V.

TREATMENT OF FRACTURES OF THE LEG.

When you glance over your surgical text-books, you are struck by the quantity of splints which have been recommended for fractures of the leg. This very multiplicity shows that surgeons have been dissatisfied with the results obtained from many of the splints actually in use.

The excellent apparatus of Scultet is inapplicable for fractures complicated with wounds, unless the dressings and bandages are changed every day. The hollow trough-shaped splints are with difficulty supported by patients, and—to say nothing of the eschars about the heel—they have the great disadvantage of causing stiffness of the knee joint and ankle if the splint be applied rigorously so as to confine the fracture for twenty-five or thirty days, the time necessary in simple cases to obtain good union; and in fractures of the middle of the leg so treated, you will always notice after patients get well, an arched condition of the limb with the concavity anterior. Dupuytren's splint for fractures of the fibula and outward luxation of the foot, sometimes gives bad results. The padded splint, and the plaster splints when put on at the first and made to surround the whole limb, have often failed to give satisfaction, for the apparatus fails to keep the fragments perfectly in juxtapo-

sition at the time when the swelling of the limb subsides, when it is necessary to put on a new splint, or give up seeking good consolidation of the fracture.

The plaster-of-Paris splint moulded to the limb, proposed by Hergett in 1874, resembles much the metallic trough splint; it supports only the soft parts, and the circular bands act as inextensible fastenings which cannot be tightened; and this constitutes one of the disadvantages of circular plaster apparatuses.

The hollow wire splint of Charles Larazin, applied over a thick layer of wadding and made fast by buckled straps, has certain advantages for simple fractures, but it has also the disadvantage of not permitting you to view every day the state of the limb.

I have tried all these old apparatuses, and I advise you to return to the plaster splint which Maisonneuve employed for fractures of the fibula, and to apply it with the modifications which I have devised for the preparation of the plaster bandage, and the means for fastening the apparatus to the limb.

Whatever may be the nature of the fracture of the leg, whenever there are no complications rendering it necessary to amputate the limb, you can apply the plaster apparatus in the following manner:—I will suppose a case of simple fracture of the leg, the tibia and fibula being broken at about the same level, and without wound.

Take a piece, half a yard wide, of coarse tarlatan muslin (such as is used in our hospitals for the preparation of poultices); cut out a strip twice the length of the leg, measuring from the anterior tuberosity of the tibia to the sole of the foot. Fold the strip in several doubles, so as to make a band three or four inches in width.



FIG. 9.—A front view of the plaster splint for fractures of the leg.



FIG. 10.—A side view of the plaster splint for fractures of the leg.

The fracture must now be set and kept reduced by the help of an assistant.

Take a quantity of plaster-of-Paris, put it in an earthenware basin, and add enough warm water, with constant stirring, till the plaster is about the consistency of cream. Unroll the strip of muslin, and soak it in the plaster paste, working the plaster into its meshes with the hands, then fold it up again several times double, as before. During this operation, the plaster begins to dry.

The limb is held all this time by one or more assistants, who keep the foot and leg in the proper position. The surgeon adjusts the plaster band by applying the middle to the sole of the foot, and bringing the two tails up the limb, the one on the inner, the other on the outer aspect of the leg, and moulding them to the limb. The strips should not be brought higher up than the lesser tuberosity of the tibia and the head of the fibula.

When once the strips are applied, the surgeon —who has left uncovered the spine of the tibia in front, and the calf of the leg behind—takes note of the relations of the fragments of the tibia, and presses in one way or another while the splint is drying, so as to effect and keep perfect juxtaposition. While the drying is going on and before the plaster is set, an assistant keeps the foot in a straight position. As a rule, the parts are in a good position when a line passing by the middle of the ankle-joint is in the same plane as the middle line of the patella, or, better still, the inferior angle of the patella. Later on, you

will see that there are cases where we are obliged to give a special position to the limb to keep it reduced during the drying of the plaster.

On an average, it takes about a quarter of an hour for the plaster to dry, if it be of good quality, and if it be not spoiled by being too thick or too thin. There is a degree of admixture with water which should not be exceeded; the paste should have the consistency of cream, and not retain the imprint of the finger.

When the apparatus begins to dry, it is necessary to supplement and strengthen it still more with fresh plaster from the basin in which the muslin band has been soaked; the plaster paste is rubbed thoroughly by the hand over the outside of the splints, and smoothed by the fingers.

When the plaster is dry, the edges of the splints, which are more or less irregular and rough, are rounded off with a spatula; then three elastic straps with buckles are adjusted with the requisite tightness over the apparatus—one over the seat of the fracture if it be at the middle of the leg, one over the ankle, and one at the upper part of the splints. To prevent too much pressure on the skin, a square compress is placed under each strip where it passes over parts not covered by the splints; later, a little cotton batting may be placed between the edges of the plaster splint which press rather hard on the limb.

The use of the elastic buckled straps in this

plaster apparatus originated with me, and I find them altogether better than the strips of sticking plaster employed by Malgaigne, or the ordinary tape fasteners, whether made of cloth or any other inelastic material. These inelastic straps have, in fact, to be tightened every day, and they do not sufficiently yield to the distention caused by the swelling during the first few days of the fracture. For a long time, the primitive splint of Maisonneuve has been abandoned because the usage of elastic straps was unknown. In fact, the two vertical strips which constitute the splints were confined by means of a circular plaster band, and the retention thus obtained had all the disadvantages of an apparatus completely enveloping the limb. Such an apparatus is dangerous during the period of swelling of the limb, for it may cause gangrene, and is useless after the first few days, because it does not keep rigorously immovable the fragments of the fractured bone.

I lay it down as an absolute principle that the ideal apparatus for fractures is one which shall keep the fractured limb completely at rest for the first twenty days. Now the plaster splint that I have above described is a rigid mould which so well confines the limb that the patients can make certain movements, even turn over in bed with the splint on, without experiencing any pain. This plaster mould leaves uncovered a part of the limb, and enables the surgeon to see how the fracture is

progressing, which is a principle of good surgery, and the solidity of the mould is not compromised by such examination of the seat of the fracture.

The elastic buckled straps render the compression of the member more efficacious, and when they are tight, the patient moves his limb with the greatest facility. You can tighten these straps every day, or every second or third day, in order to make the splints fit more closely to the limb, and this can be done without at all displacing the apparatus, and without giving the patient any suffering.

If there be any other apparatus which offers the same advantages, I do not know of it.

An American surgeon, Fluhrer, of New York, has communicated to the Surgical Society a memoir in which he treats of apparatuses for fracture of the leg; the plaster splint in his practice is replaced by one made of a narrow strip of tin, applied over a flannel roller, a plaster bandage covering the whole. This splint, as well as the wadded apparatus of Alphonse Guérin, does not keep up sufficient pressure over the fractured surfaces as soon as the swelling has disappeared, and there is no means of tightening the splints without undoing the apparatus, which is certainly a great disadvantage. Add, also that if the fracture is badly reduced, the apparatus masks the bad result at the moment when the mal-adjustment should be noted and attended to.

As for the efficacy of this apparatus, the following cases speak sufficiently in its favor:

CASE 1.—*Simple fracture of the fibula; multiple fracture of the lower extremity of the tibia; contusion of the ankle joint.*—M. L.; gypsum moulder; aged 38 years; of strong constitution; entered Cochin hospital March 13th, for fracture of leg, a plaster image having fallen from a considerable height on that member. The force of the injury was sustained by the lower third of the limb; the patient could not lift himself up, and was removed to the hospital.

The first thing to note was an enormous swelling over the contused region, the lower third of the leg being the seat of a firm muff-like tumefaction; the foot was turned slightly backward and everted by its own weight; there was ecchymosis. Palpation revealed a considerable sanguineous effusion into the bruised tissues, as indicated by a coarse crepitus resembling starch crushed between the fingers. The crepitation caused by the fracture was not very perceptible, as is the case with V shaped fractures of the lower extremity of the tibia. If, taking hold of the foot with the left hand, with the right grasping the leg above the point of injury, we endeavored to execute movements, we perceived an abnormal mobility, and a very well marked crepitus; the tibia and the fibula were fractured at the same level. The examination was very painful.

The injured limb was immediately put up in two lateral plaster splints, which were kept in position by three elastic straps, one of which was buckled over the seat of the fracture. These splints kept the fracture reduced, and opposed the retroversion of the foot. The pain soon in great measure subsided. Opium pills; seltzer water, one glass.

March 14th.—The patient has slept. There is an abatement in the swelling and the suffering.

There was nothing particular to note on the following day. The straps were tightened every day.

The sixth day the patient was able to rise, and with the help of crutches to move about the wards.

Twenty-eight days after the fracture (April 12th) the plaster splints were removed. There was a large callus well organized but not yet quite solid over the lower extremity of the tibia; the patient could not bear his weight on the foot. A silicate bandage was now put on, and the patient was able to walk about with crutches.

Three weeks afterward, the silicate dressing was removed; the callus was quite solid and the foot straight; only the patient could not yet use the limb; moreover, when he remained long standing, there was an œdematous swelling about the malleoli.

One month afterward we saw the patient, who during this time had been at his home; he still made use of a cane, and was not very firm on his leg, yet could attend to his business; there had been a progressive gain.

A few months afterward, M. L. again presented himself; he had long been walking very well without a cane; there was hardly any appreciable callus at the seat of the fracture.

CASE 2.—*Fracture of the fibula by divulsion, with separation of the internal malleolus, and luxation of the foot outwards and backwards.*—J. B. M. entered Cochin Hospital May, 27th, 1887. Had fallen from a height, on the left foot, fracturing the leg and dislocating the foot. Two physicians had recognized the nature of the fracture, and endeavored in vain to reduce it.

Condition on Admission.—At the inferior third of the leg, outer aspect, there is a depression as if made by a blow from a hammer; the foot is considerably everted, carrying the outer malleolus with it in its rotation outward; the foot is also a little dislocated backward; the transverse diameter of the tibio-tarsal articulation is greatly augmented, as well as the antero-posterior diameter.

These deformities warranted M. Després in the diagnosis of fracture of the fibula by divulsion; he knew also that there must be a fracture of the tibia, but where? On moving the

foot back and forth, a very plain crepitus was heard over the region of depression of the fibula. The sharp line of the tibia could be felt throughout its whole length; there was, then, no fracture of the tibia affecting its body; but on the level of the internal malleolus, near its tip, the finger moved over a rough surface which was not that existing in the normal state. Here the finger sank in—there was was no pain on movement, but crepitus could be felt. The nature of the deformity was such as could only result from a wrenching asunder of the internal malleolus.

It was decided to apply the plaster splints immediately. The fracture was a difficult one to manage—the dangers were anchylosis at the ankle-joint, and vicious consolidation. In setting the limb, M. Després made much account of position. The two plaster splints were first adjusted in the usual manner; then, while the plaster was drying, the patient was turned on his left side, and the limb made to rest by its outer aspect on a firm, hard cushion tapering towards the knee. On pressing firmly upon the internal and anterior aspect of the limb, the counter-pressure exercised by the hard cushion sufficed to effect reduction of the dislocated foot. During this time, and while the assistants held in place the plaster splints, the plaster solidified, and the apparatus kept the member imprisoned in just the position required. M. Després, knowing the ease with which such displacements return, prescribed for the patient the same situation and the same position. These two means, the plaster splints, and their precious adjuvants in a case of this kind, *position* (the patient lying on the side, the member resting by its outer aspect on a hard cushion or sand bag, and strongly attached to it by a couple of folded handkerchiefs) sufficed to keep the fracture reduced.

On the eighth day we allowed the patient to lie on his back, with only the splints to support the broken limb. On the sixteenth day, there was some redness and pain over the inner

malleolus, and a little eschar formed over the place where the edge of the splint pressed; the splint was removed and readjusted; the displacement no longer existed. The twenty-sixth day the apparatus was removed, and a commencement of consolidation was noted; a silicate bandage was applied.

A month and a half after the fracture, the silicate bandage was removed and consolidation found to be complete, and the foot in its normal position. There was a good deal of swelling about the ankle, yet the patient could move the joint slightly. A silicate bandage in the form of a spica was applied about the foot and ankle to support the joint in walking, and the patient was allowed to walk about with crutches. He ultimately recovered with the full use of his member.

CASE 3.—*Fracture of the left leg, protrusion of the superior fragment.*—E. V., aged 21 years, a quarry-miner, entered Cochin Hospital July 2nd, 1875. He had met with a severe accident by the falling of a staging; was crushed amid the ruins with one of his comrades who was killed instantly. The right leg was bent to a right angle, and both tibia and fibula were broken at the same height. The lower fragment of the tibia had perforated the skin making an opening which admitted the index finger. A large effusion of blood had produced a considerable tumefaction of the limb, especially at the internal part where the liquid crepitation was most evident. The crepitus occasioned by the broken bones had been perceived by the hospital interne on the admission of the patient. The abnormal mobility and the angular deformity of the member at the seat of the fracture were so evident that no more minute examination was deemed necessary.

After having dressed the wound with strips of sticking plaster, which arrested the hæmorrhage, M. Després applied the plaster bands on July 3d; these immediately gave relief to the patient, who was able to lie on his side. The deformity being

not sufficiently corrected by the splints, M. Després applied a new plaster apparatus July 4th. On the 6th he was again obliged to adjust a new plaster apparatus, and after having straightened the limb, he placed the plaster bands in position and maintained the reduction during the setting of the plaster.

On the 12th suppuration set in, after which the patient had for three days a slight febrile movement, and some œdema about the feet and ankles.

The following days, the elastic straps were regularly tightened; on the 20th the pus which flowed from each side of the plaster strips was a little more abundant.

August 2nd, the splints were removed and two ulcerated surfaces were found: these were covered with rosy granulations which were healthy in appearance.

The lesion noted on the day of the patient's admission was the origin of one of these ulcerated spots; it was the orifice into which the finger had been introduced in exposing the fracture of the tibia; the other solution of continuity was the remains of an abscess which had opened of itself, and had formed over the broken fibula a little below the site of the fracture of the tibia.

The fracture was consolidated, but the callus was still somewhat soft. The patient was placed in a silicated wadding dressing, the wounds being previously dressed with imbricated adhesive strips; with this apparatus the patient was able to get up and walk around on crutches.

The patient went out of the hospital August 17th, on business, and returned August 19th. Desiring to investigate the state of the limb, M. Després removed the silicate apparatus; the wounds had grown smaller, and the bones were solid. Nevertheless, a new silicate dressing was applied. Sept. 15th the patient was enabled to walk with a cane.

Sept. 16th, the apparatus was removed; the primary wound was cicatrized—the other had not quite healed. All

swelling had disappeared; both bones were found firmly consolidated at the seat of the fracture; the tibia was perfectly straight; there was a little projection of one fragment of the fibula at the place where it had been broken. Patient remained in the hospital a few weeks, to be treated for his wound, which was dressed with diachylon every four days.

October 11th, the patient left the hospital, well, without any stiffness of the ankle-joint.*

This case is in no small degree instructive. Three times in eight days the retentive apparatus was changed on account of the difficulties of perfect adjustment; suppuration at the seat of fracture took place after these dressings, and there was no untoward result. Consolidation of the fracture, and cicatrization of the wound, went on regularly.

What would have happened if we had made use of one of those apparatuses which completely hide the member, and where the surgeon is unable to inspect the seat of the injury? We should have had

*In bad cases of fracture of the tibia, especially when both bones are fractured, or when there is a compound fracture, I prefer the fracture-box with little sandbags each side of the limb. The sandbags may be dispensed with, compresses of cotton cloth or wadding being used instead.

The fracture-box is so much in use that no description here seems necessary. I have sometimes found advantage in moderate extension, the plaster strips being fastened to the footboard. Such a case I had with Dr. Montgomery in the Anna Jaques Hospital recently; the Desprès apparatus not proving satisfactory, we put up the fractured limb in Day's wooden splints, and then encased the whole in the fracture-box; strips of plaster from the ankle enabled us to make extension over the footboard. In this way we secured a permanently good position for the foot.

In country practice I have extemporized a fracture-box with two short pieces of clapboard and a large silk handkerchief.—TRANS.

a vicious union, with deformity of the limb, purulent outbreaks, and excoriations of the skin, so often observed when those hollow splints which completely cover the limb are used, and which are not renewed every eight days at least, or when, in any way, a limb which is the seat of a compound fracture and certain to suppurate, is placed in an immovable apparatus which conceals it from observation. The fracture in such a case is but imperfectly retained, and the inflammation is sure to be more active and formidable. All of the above observations pertain to complicated fractures of the leg; I have thought best to omit simple fractures, which are common enough, and in which the success of the plaster splints is more evident without being so striking.

You have seen at the clinic two children—one of nine, the other of thirteen years of age—who had a fracture of both tibia and fibula at different heights —fractures which were the result of a fall. The plaster splints were put on immediately. The parents brought the children to our clinic, first every four days, then every eight days, for examination. The twentieth day the children were able to bear some weight on their legs; the thirtieth day the parents could no longer keep them still; and the fortieth day the splints were removed. The elastic straps were tightened every four days. At the end of forty days the children walked without help and without limping; the bone was only a little larger than natural at

the seat of the fracture; there was no stiffness of the knee or ankle.

I need not remind you that fractures of the fibula alone have been treated in this manner; the efficacy of the apparatus in given cases is the best demonstration of its utility.

To sum up: I will state in the form of propositions the indications for the application of the apparatus.

The fracture must be reduced during the application of the plaster band. The plaster paste should be made thick enough so that it may dry quickly, and the limb be kept in good position till the plaster sets; this demands about ten minutes.

The elastic straps should not be applied till the splints are quite hard and firm, and it is not best to buckle them very tightly the first day.

The second or the third day, the straps should be tightened as much as the state of the limb will permit; *i. e.*, the constriction being measured by the degree of tension of the limb.

The following days the straps must be tightened as the swelling goes down; it takes about six days for this to disappear. The tightening of the straps is an affair which requires some tact; you must examine to see if the straps are at all loose, and, tighten them till the mould formed by the splints is well adjusted to the leg. After the sixth day, the patient will himself note if the apparatus becomes

loosened; he feels an uncomfortable sensation of lack of support.

If you wish to attain perfection,in fracture of the tibia with extensive displacement, you will on the eighth day put on a new plaster apparatus like the first. The splints will hold better than those first put on, as the swelling is all gone the eighth day, and retention is better attained with a new dressing. This is not necessary, however, in most cases. The twentieth day, you can replace the plaster splints by a silicate bandage, but patients prefer the former, and I have adopted the plan of leaving on the plaster for forty days or more; if the limb is solid at the end of this time, I remove all retentive apparatus. Where consolidation is still incomplete, I put on a silicate bandage and leave it till the sixtieth day, or a new plaster splint, which, may remain till the seventieth day, according to the gravity of the fracture and, especially, the degree of comminution, for a comminuted fracture is always very long in undergoing consolidation.

Since the first publication of the foregoing (first edition, (I have obtained a good result in a fracture of the fibula with a separation of the internal malleolus and luxation of the foot, in sixty-five days, with a plaster dressing left on all this time; the patient walked without a cane on the sixty-fifth day. A fracture of the tibia by direct violence has got well in sixty days with only one plaster dressing. A fracture complicated with wound of the tibia and fibula at the same height has got well in seventy days; at the

end of this time the patient could walk without a cane.

Does a complication supervene—an erysipelas, a suppuration? All you have to do is to loosen the straps; the splints will still hold because they are moulded to the limb. You will cover with sticking plaster, or pad with cotton or soft lint, the point where the edges of the splints press, in order to avoid eschars. It is necessary also to make provision for the discharge of pus. You will apply to the parts of the limb not covered with the splints poultices of linseed, or warm compresses wet with infusion of elder flower, and wait the subsidence of the inflammation. If there is a loose splinter of bone, you can extract it without touching the apparatus, or by simply moving it to one side.

This apparatus presents numerous advantages of which the principal are as follows:

1. It keeps the fragments in place as well as any other splint, and it assures a good conformation of the limb.

2. It does not immobilize the knee or ankle, and thus saves the patient two months of convalescence, the time necessary for the re-establishment of the functions of these joints when they have been immobilized by the application of other apparatuses, as the Hergott and Sarazin splints.

3. It enables patients to lie in all positions, and to move their limb about from the very first day,

which is an incalculable advantage; we do not, fear eschars of the heel, so common when the hollow trough-shaped splints are employed, and the patients experience real comfort in being able to lie on the side, instead of having to lie from twenty to thirty days on the back.

4. In fractures with luxation of the foot, it keeps the fracture well reduced without the need of any special strapping or other contrivances. If you will take care to place the limb in a position which favors the reduction of the fracture and of the dislocation during the drying of the plaster, you will not need to trouble yourself about anything else.

5. In fractures complicated with wound, you will place a dressing consisting of imbricated strips of adhesive plaster and a little lint or absorbent cotton to regulate compression over the wound, and then put on the splints, without any other modification than this dressing by occlusion after Chassaignac's method.

The external conformation of the limb ought to be as good as that obtained with any other apparatus, even if there has been loss of substance of the bone. But it is especially in fractures of the fibula with separation of the internal malleolus that the result is excellent. Dupuytren's splint, and the trough-splint often give enormous deformities, and you have all seen one of our very estimable *confrères* who, after a fracture of this kind, and the application of the

Dupuytren splint and fracture trough, has now such a deformity that he cannot walk without a shoe specially adapted by iron braces to give support to the limb; while the patient whose case we have above published (case 3), who had a dislocation of the foot which had resisted all attempts at reduction before his admission to the hospital, went out of the hospital without limping, and without any other deformity than a little swelling about the ankle.

The apparatus offers certain disadvantages which pertain exclusively to want of care in the application of the splints; and it is at the moment when the patients begin to support themselves on their limb that accidents are generally observed. These accidents, which are, however, of but little gravity, are eschars at the points where the edges of the splints compress the skin over a bony prominence, as, for instance, where the upper part of the splints presses on the internal and external tuberosities of the tibia; but these accidents may be avoided by not carrying the plaster strip quite up to this point when adjusting the retentive apparatus; or you can later cut out with a pair of shears the extremity of the strip which is causing inconvenient pressure on the tuberosity. I have also observed eschars over the internal malleolus, which were produced by the edge of the splint pressing on the point. This evil is remedied by putting on another plaster apparatus; the eschar is dressed with strips of sticking plaster, and a new

plaster band, larger than the other, whose edges pass beyond the malleolus, is applied over the adhesive strips, and the eschar promptly heals.

The surgeon's principal duty then is to see during the application of the splint that its edges and angles shall not press on a point of the skin covering a bony prominence.

Some special indications ought also to be fulfilled in particular cases. When in a compound fracture there are loose splinters of bone, they must be at once removed, and adhesive strips applied, with dry dressing, before the plaster apparatus is put on.

Subsequently, during the treatment of the fracture, when secondary exfoliations take place, the splints must be removed, the bony fragments extracted, and a new plaster dressing applied.

Lastly, if an erysipelas supervenes of the member around the wounds which complicate a fracture, the splints must be loosened, without being removed, in order to avoid the formation of eschars at the points where the edges of the splints press; and it may be necessary to place pledgets of cotton bebetween the straps and the skin, at the same time that you apply over the eschar strips of diachylon.

There exist, as you see, for the plaster dressing, the same inconveniences which attend all other apparatuses when they cover a limb affected with erysipelas or phlegmon. I have already once observed a case of this kind; the patient was an old woman

seventy-eight years of age, who had had a simple fracture of the tibia, complicated with a wound on the right leg and sprain of the left foot, caused by a carriage-wheel passing over her. The plaster dressing, applied immediately, rendered the usual service, but an erysipelas supervened, with eschars over the sacrum, and at the same time the contused parts of the skin of the foot and of the leg, even those outside of the splints, were smitten with gangrene. During only one night, an eschar formed at the point where the plaster band pressed on the outer aspect of the member. A suitable dressing arrested the progress of the eschar, and the fracture continued to be well supported, although the straps were loosened. This poor woman succumbed the fifteenth day without any suppuration at the seat of the fracture; she died exhausted by an eschar over the sacral region two hand's-breadth in extent.

Here is another observation where a fracture of little gravity was successfully treated by the plaster dressing in a relatively short time, and with but little inconvenience to the patient:

CASE 4.—*Fracture of the leg by direct cause; double effusion into the joints; immediate plaster dressing.* C. L., aged 22 years, day laborer, entered Cochin Hospital July 26, 1875.

Fell from a mast-top, and found himself helpless. Twelve hours after the accident, his attendants noticed on the left leg, and about the tibio-tarsal articulation, a deformity characterized by considerable swelling and an elongation of the transverse diameter of the limb at this point. The malleolar prom-

inences had disappeared, and the ankle no longer presented a natural appearance; the foot was not displaced backward; the color of the foot was unchanged.

Spontaneous movements were impossible; provoked movements, a simple pressure even, were very painful; absence of crepitus, but depression and excessive pain over and above the two malleoli. There was a little effusion into the knee joint.

M. Després diagnosticated a double malleolar fracture without displacement of the fragments of the tibia.

July 27th, a plaster apparatus; immediate relief to the patient. Six days after the application the patient rose and commenced to walk with the help of crutches.

August 15th, the 20th day, he could walk with the help of a cane.

August 31. The apparatus was removed; the patient walked freely; there was no deformity though the fibula was thickened, being augmented in diameter, to three centimetres, above the malleolus; the inferior extremity of the tibia was notably larger than that of the opposite side; the tibio-tarsal articulation was free, and had preserved its normal movements.

The patient left the hospital Sept. 6th, the 42nd day after his accident; he was still a little weak on the leg, but walked without a cane.

Here the rapidity of the cure was due to the age of the subject.

I will cite, in concluding, the case of a young patient who is in the same conditions as the one who was the subject of case 3 (immediate extraction of the bony splinters, immediate plaster dressing); the wound suppurated under the plaster apparatus; the 60th day the patient walked without crutches, and a

little spiculum of bone the size of the head of a pin escaped from the wound; the 65th day the plaster apparatus was removed. The patient recovered about the third month without any stiffness of the joints.

In general, the treatment of fractures of the leg by the immediate plaster apparatus, left in place all the time, lasts—for fractures of the fibula above the tibio-tarsal joint, whatever may be the height—from 35 to 40 days. After this time, the patients walk without crutches, and have no traces of the fracture except a temporary swelling of foot, which ceases during the night, and for about a month returns during the day time.

For fractures of the tibia with only one line of fracture, forty to fifty days, and one month of convalescence with swelling of the foot. The patients walk the sixtieth day without a cane.

For fracture of the fibula, with separation of the internal malleolus, the treatment lasts from forty-five to seventy days, but walking without crutches, that is to say complete restoration, is often not possible till the fourth month.

For fractures of the tibia, with several fragments, or with impaction and crushing of the bone, the patients must keep on their splints seventy days, and there is one month of convalescence with swelling of the foot, as in the case of all other fractures.

For comminuted fractures. with loose spicula of bone which have to be extracted, recovery is re-

tarded by the time necessary for the elimination of the eschars of the soft parts, and for suppuration—*i. e.*, about twenty days.

Fractures of which one of the lines has penetrated a joint, are those which require the most time. Two months and a half with the plaster dressing are generally necessary.

If you compare the duration of the treatment by the immediate plaster dressing, with the treatment by other apparatuses, you will see that the difference is great, and that the stiffness of the joints caused by the immovable apparatuses is the real cause of the prolonged duration of the convalescence. If recovery is retarded when use is made of the plaster apparatus, this is due to a rheumatic disposition, which entails a dry arthritis and stiffness of the joint. But this complication is also observed, and is even more common, after the employment of other apparatuses.

CHAPTER VI.

FRACTURE OF THE PATELLA.

(By the Translator.)

The original text contains no chapter on fractures of the patella.

This fracture is usually transverse, the result of muscular action, or muscular action combined with violence. There is great swelling and effusion into the knee joint. This fracture is generally treated by a straight splint along the back of the limb, with elastic straps to pull the upper fragments downward, and the lower upward, and a figure-of-eight bandage, The swelling is kept down by bandage and compress, plenty of cotton wool being used. Wiring the fragments, under antiseptic precautions, has been employed with success in both private and hospital practice; the operation is not, however, free from danger (See London Lancet, 1880, Am. Ed., 1st Part, p. 380). The plaster-of-Paris bandage, though condemned by Hamilton, has given good results in the practice of many American surgeons. Dr. James L. Little, of New York,* speaks enthusiastically of this mode of treatment in the Medical News, March 29th, 1884, the principal part of whose communication we reproduce.

* Prof. of Clinical and Operative Surgery in the Post Graduate Medical School, New York, etc.

"The method which I propose to describe is by the use of the plaster-of-Paris splint, which was first introduced by me in 1861, and first applied to a fracture of the patella in 1863, in a patient of the late Dr. Tucker, of New York, and which I have used in all the cases that have come under my care in St. Luke's and St. Vincent's Hospitals, as well as in my private practice.

"Immediately after the receipt of the injury, I elevate the limb slightly and place it on a pillow, and wait until the swelling and inflammatory action which follow have subsided. The limb is placed in this position simply for the comfort of the patient, and not for the purpose of relaxing the quadriceps extensor muscle and thus preventing the separation of the fragments, which was formerly considered necessary. Although I have often attempted, I have never been able to demonstrate that it made any appreciable difference, in regard to the separation of the fragments, whether the limb was in a straight position, or the thigh flexed on the pelvis.

"Sometimes, when the effusion into the synovial cavity is great, I apply pressure, as soon as the patient is able to bear it, by means of a bandage. When the swelling has subsided, which takes from four days to a week, the following dressing is applied: A posterior splint is made of two thicknesses of bleached Canton flannel, strengthened in the middle, (under the knee), by two extra layers; this is made

long enough to reach from a little above the ankle to above the middle of the thigh, and wide enough to cover two-thirds of the circumference of the limb above and below the joint; but at the joint it should only just cover the condyles of the femur. Two pieces of Canton flannel, of from two-and-a-half to three inches in width, double thickness, one long enough nearly to encircle the limb at the ankle, the other to encircle it at the upper third of the thigh, are prepared at the same time. The pieces designed for the posterior splint are then thoroughly saturated in a mixture of plaster-of-Paris and water, taking care that the mixture is not too thick,* and then smoothed out upon a board with the hand, and applied smoothly to the limb. Then the two bands are prepared in the same way and applied around the upper and lower extremities to hold it in position. A dry roller bandage is then firmly applied over all, and the plaster allowed to set.

"As soon as this is accomplished, the bandage is removed, and we have a firm posterior splint, secured above and below by transverse bands.† Two other strips, of a double thickness of Canton flannel, an inch wide, and long enough to overlap on the posterior surface of the splint, are saturated in a fresh mixture

* "Superfine or dental plaster should be obtained. The mixture should be about the consistency of cream."

† "Sometimes I apply a third band between the knee and the lower one."

of plaster-of-Paris, and then tightly applied above and below the patella, while the fragments are held in position by an assistant, in the same manner as adhesive straps are used for coäptation in this fracture. A dry roller bandage is then rapidly applied with figure-of-eight turns over the strips. The surgeon then, with thumb and finger of each hand over these coäptation bands, forces the fragments into close approximation,* and holds them there until the plaster has set. The bandage is then removed and a fresh one applied over the whole length of the limb. The dressing is then complete.

"It is a good plan for the surgeon, before applying the coäptation bands, to see that the fragments can be easily approximated. In a number of cases I have found some difficulty in keeping the fragments in the same plane, or in preventing them from tilting, there being a tendency of one to rise above the other. This can be overcome by making pressure with the fingers over the line of fracture while waiting for the bands to harden.

"*This dressing differs essentially from all others, in that the fragments are adjusted by the hands of the surgeon, and the 'setting' of the plaster keeps them in the exact position in which they were held.*

* "The lower coäptation band holds the lower fragment fixed, and at the same time enables the surgeon to make counter-pressure while he forces the upper fragment in position."

"With this dressing the patient is not compelled to keep his bed, but may sit up or go about on crutches with but little inconvenience.

"This apparatus, like all plaster-of-Paris splints, should be applied directly against the skin, care being taken, however, to remove the hair, or else smear the limb with vaselin or oil.

"The condition of the fragments can now be examined at any time by simply removing the bandage, and, in case any separation has taken place in consequence of the shrinkage of the limb, it can be corrected by removing the coäptation bands and applying new ones. Care should be taken, if this becomes necessary, which is seldom the case, to moisten the posterior splint in order to insure the adherence of the new pieces.

"This overcomes one of the objections urged by Dr. Hamilton—the inefficiency of this dressing as a means of approximating the fragments. Another objection which he makes, in regard to the weight of the splint, is not at all applicable, as patients have never complained of this, and I doubt very much if it weighs any more than the apparatus he recommends.

"Pressure sores have never been produced in my experience, nor have the patients ever complained of any pain caused by undue tightness of the dressing. In fact, constriction of the limb by the splint, bands, or bandages, so as to interfere with the circulation,

cannot occur, even in inexperienced hands. In this respect it is safer than the plaster-of-Paris bandage which Hamilton so justly condems.

"In order to prevent a rough edge at the upper and lower extremities of the splint, it is advisable to fold them over about half an inch, thus bringing a perfectly smooth edge in contact with the soft parts.

"This dressing should be left on for from six to eight weeks. The majority of patients rarely have any appreciable separation of the fragments at the end of the treatment, but as the union is generally ligamentous, a certain amount of separation will take place in time, as in all cases in which there is not bony union.

"In comparing this method with the one of wiring the patella, under antiseptic precautions, which has lately come in vogue, I am inclined to give the preference to the one just described, or to any other form of dressing which results in close ligamentous union: The patient is not submitted to a surgical operation which may endanger his life or the usefulness of his knee-joint, for, with the utmost care in antiseptic measures, there is still the possibility of serious complications. I think all surgeons will agree, that a moderate amount of separation of the fragments by a ligamentous band, does not in any way interfere with the usefulness of the limb. Hamilton says 'that if the ligamentous band is not more than an inch in length, the use of the limb is not im-

paired.' In a case, about two years ago, a patient, aged twenty-two, broke his patella transversely below its middle. He was treated by me in St. Luke's Hospital, and was discharged with a ligamentous union of less than half an inch. Six months after, he slipped in walking, and fractured the same patella about half an inch above the first fracture; this also united by ligament. In this case the ligament proved itself stronger than the original bone.

"If, then, ligamentous union of moderate length does not impair the usefulness of the limb, and is as strong, if not stronger, than the original bone, why should we submit the patient to any serious danger in order to obtain bony union, which at the best is of questionably utility?

"While bony union, obtained by wiring, may be the goal for which the idealist strives, I question whether this mode of treatment can ever be conscientiously adopted by conservative surgeons."

INDEX.

PAGE.

A

American Splint for Fracture of Thigh..... 59

B.

Barton's Fracture..... 17
Bond's Splint..... 17
Bonnet's Trough Splint..... 59

C.

Clavicle, Fractures of..... 10
Colles' Fracture..... 17

D.

Daniel's Fracture Bed..... 78
Desault's Splint..... 67
Desprès' Plaster Splint for Fracture of the Leg..... 82

E.

Extension in Fractures of the Olecranon..... 53
Extra-capsular Fracture of the Thigh..... 74

F.

Femur, Fractures of..... 58
Fluhrer's Splint..... 83

H.

Hennequin's Splint..... 59
Hergett's Splint..... 80
Humerus, Fracture of..... 18

I.

Intra-capsular Fracture of the Thigh..... 73

Page.

L.

Leg, Fractures of 79
Lefort's Splint 72
Lewis' Splint 16
Liston's Splint 17
Little, James L., Treatment of Fractures of Patella 102

M.

Malgaigne's Splint 5

O.

Olecranon, Fractures of 29

P.

Patella, Fractures of 103
Phalanges, Fractures of 44

R.

Radius, Fractures of 4
Ribs, Fractures of 34

S.

Sarragin's Splint for Fractures of Thigh 76
Smith's Anterior Splint 62
Stockwell's Modification of Smith's Anterior Splint 61
Ulna, Fractures of 49

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